its supplies from Mackinaw, I would say that as you have read me the passage, Keating was doubtless reporting
1145 what was pretty closely the condition of affairs. As to whether there is plenty of record of the passage of trade in the early part of the 19th century by the Fox-Wisconsin route to the Mississippi, I would say there is enough record scattered through the years to give one a pretty good notion of what was going on over the Fox-Wisconsin. I do not know of any record during the early part of the 19th century and up to 1825 of any merchandising going on the Desplaines-Chicago except the fur trade to which you have referred. As to whether there is any record of any settler moving into the valley of the Desplaines or the valley of the Illinois, who took the water route of the Desplaines, I am not familiar with the history of agricultural pioneering in the valley of the Desplaines. I have now in my memory no such record. As to whether if, as a matter of fact, the country was visited in 1907, and practically all the early
1146 settlers were interrogated, living along the Desplaines river, some of whom came in the early 30's, and none of whom came in by boat, or knew of anybody else who came in by boat, it would be fair to assume that travelers did not go to St. Louis with merchandise in the early part of the 19th century other than the fur traders to which I have referred, I would say that there is a well known rule of historical evidence that one piece of positive evidence is worth any quantity of negative evidence. I should look with considerable doubt upon the statement of a man made in the year 1907 concerning conditions that existed within his memory previous to the year 1830. As to whether I think that anyone who came into the country could fail to know how he came in if he were above the age of infancy, I would say his testimony as to how he came to the country I would value as good evidence. As to whether, assuming that 50 persons testified to coming into the country prior to the building of the railroad or the opening of the canal, and that not one came by the river, but settled along in the region of the river, that would have any weight in my judgment in determining how much use had been made of the river as a
1147 line of trade and commerce, or of travel, I would say it would have a certain value as far as it went as to how American agricultural pioneers came into the valley. It would have absolutely no influence on my mind as to whether the fur trade or early commerce in general was conducted

by boats over the Desplaines river, coming from Lake Michigan.

1148 Q. Then let us come to commerce. Suppose that in the days before the canal was built and before the railroad was built all of the merchandise to supply that country was brought either from the head of navigation on the Illinois by wagons, or from Chicago by wagons, and none was brought by the Desplaines river, would that have any effect in your judgment as to the availability of that route as a route for trade and commerce?

Objected to as not proper cross-examination, and further, upon the ground that it is based upon a hypothesis which there is no evidence in the record to justify.

A. I should not consider that testimony showing that wagons were frequently used in transporting goods from Chicago to the Desplaines river at a time subsequent to the beginning of agricultural pioneering when horses and wagons were introduced to the country, at all influenced the evidence relative to the use of the route of the Chicago-Desplaines by means of water craft for an earlier commerce and means of travel.

Q. Assume that before there were any settlers in the district in question, when there was no house or white inhabitant between Peoria and Chicago, there was a well traveled wagon route and horses and wagons kept for the

1149 purpose of transporting merchandise from the head of navigation on the Illinois river, the roads not being built for farmers, there being none; would that have any weight in determining the availability of the Desplaines route as a route for trade and commerce?

Same objection.

A. No, it would not, because in judging of these matters the historians must always have in view the condition of affairs that existed upon other routes that were used between the great lakes and the Mississippi; and upon the Fox-Wisconsin waterways. From quite an early period in the nineteenth century before there were any settlers around about, horses and wagons and sledges were used for transporting boats, canoes and their cargoes between the Fox and Wisconsin river, a distance differing somewhat according to the stage of water, but in general about one mile and a half. I am aware that when counsel was speaking of the head of navigation of the Illinois river and the Desplaines that he was talking of a road of more than fifty miles in length, paralleling

the entire length of the Desplaines river. As to whether
1150 I think that a condition that existed of transporting over the portage, a mile and a half, by wagons was analogous to a condition of transporting fifty miles by wagon, I would say I was not referring, in speaking of the Fox-Wisconsin, to the length of the route. I was referring to the introduction of horses in the transportation of goods. As to whether there is a particular significance in the introduction of horses which were used for the whole length of the river at a period before the settlement of the country for the purpose of transferring goods and merchandise for the whole length of the river from Chicago down, I would say you are referring to a condition of affairs concerning which I am not fully posted. The government did me the honor to ask my opinion relative to certain historical incidents. That is not among them, and I have not made a study of this wagon route. As to whether the government referred me to Graham and Philips, among others I
1151 would say it did, and if that account is in Graham and Philips then I take back my statement. As to whether
1152 Graham and Philips' report says that certain seasons of the year the portage is fifty miles, and also refers to the fact that the French kept wagons there for the purpose of transferring the boats, and so forth, of the traders, I would say that the report of Graham and Philips which is before me gives the distance of portages, the length of portages at various seasons of the year, stating that at one season there is uninterrupted water communication between the Mississippi and the Michigan lake; at another season a portage of two miles; at another a portage of seven miles; at another a portage of fifty miles from the mouth of the
1153 Plein to the lake, over which he says, as you have stated, that there is a well beaten wagon road and that boats and their loads are hauled by oxen in vehicles kept for that purpose by the French settlers at Chicago; and, I also notice that this report is made in the year 1819 at a time or in a year when according to the evidence that I have read the lowest stage of water known in this country was obtaining.

I am quoting now from the report of the United States Deep Waterways Commission, published by the government in 1897, at page 183, wherein there are two sentences: The first sentence is quoting from Foster and Whitney's report on geology, etc., and says: "Dr. Houghton gives the following table of heights from a comparison of his own observations

on Michigan, Huron and Superior with those of Higgins, Whiting and Hathan for month of June each year, taking the lowest stage of water 1819-20 as zero."

At another place on the same page, quoting again from Whittelsey, is this phrase: "The old French inhabitants of Detroit have no tradition of a water level below that of the year 1819 although Detroit has been occupied since 1702.

I therefore take it that the time of Graham and Philips' report in 1819 there was a phenomenal lowness of water.

The government report to which I have just referred
1154 was handed to me by Professor Cooley, who sits in the room, after I came back from luncheon. My attention had not been called to it before that time, not to this specific report, but I had in my mind a general remembrance that somewhere about this time there was very low water in Lake Michigan, because there are certain points in Wisconsin history that hinge upon that fact. I was glad to have Professor Cooley hand me the report in order to verify my remembrance.

Q. Is it your judgment that that road to which Philips refers grew out of the fact that that particular year was a season of drought?

A. From the testimony which I have read relative to the different stages of water over this portage route I arrived at the conclusion as stated in my general conclusions toward the end of my direct testimony, that the stage of water and therefore the length of the portage varied very greatly from year to year and season to season. It was interesting to me to discover that Graham and Philips' report was made during the summer of the lowest water on record.

Motion to strike out answer as not responsive to the question.

(Question read.)

1155 A. I should say that such a road doubtless existed and was used in the manner spoken of by the old French inhabitants of that region who were engaged in transportation for the fur trade, and that the length of it depended upon the stage of water in the Desplaines river and in the Chicago river; and that the custom grew up from the fact that at times of very low water some such means of communication would prove a very great convenience in the conduct of the commerce of that region.

As to whether Philips in the concluding paragraph of his report, where he speaks of the route generally as presenting

at one season of the year an uninterrupted communication, and so forth, at another season a portage of two miles, at another a portage of seven miles, and another of fifty miles from the mouth of the Plein to the lake, is speaking of the varying conditions during each year and not of conditions in the year in which his report was made, I would say I think he is alluding to general conditions as he understood them, but his report would be more or less influenced by the particular conditions which obtained at the time of writing the report.

Q. You find, do you not, indications in others to whom you have referred, of the existence of such a necessary portage in other years than the year in which Philips wrote, and I call your particular attention to Schoolcraft, where, describing his trip overland because his canoes could not come up the river, he says:

1156 "We have, however, seen its channel at a sufficient number of places to determine that it has several long and formidable rapids which completely intercept navigation at this sultry season.

A remark that has been confirmed by meeting several traders on the plains who had transported their goods and boats in carts from Chicago Creek, and who informed us they thought it practicable to enter the Illinois at Mount Joliet. This would lengthen the portage to about thirty miles."

Q. Does not that indicate to you that this necessity of carrying boats and their cargoes by carts was not peculiar to the year in which Philips' report was written?

Whereupon counsel for the government objected to the question as not proper cross-examination, and on the further ground that the book is not shown the witness so that he may examine the passage in question, and the passage shown the witness being a mere extract which was cited in the state case of *People* v. *The Economy Light & Power Company* and which is not correctly quoted from the book.

1157 A. The substance of my remark which is made above relative to Graham and Philips' reports of a portage of fifty miles, was that the extraordinary and apparently phenomenal lowness of the water in that year might well have accounted for the length of the portage which Graham
1158 and Philips allege. I have already stated my conclusion that land portage or portage did exist, and that

they varied very greatly in length according to the season of the year and the height of the water.

Whereupon counsel for the defendant moved to strike out the answer as not being responsive to the question.

(Question re-read.)

A. Frankly, Mr. Scott, I consider my answer an answer to your question. I am not willing to say yes or no without qualifying my answers.

1158 I do not remember that in this passage Schoolcraft was talking about cutting a channel to afford navigation for boats of eight or ten tons burden. At this place, page 1051, to which you call my attention, Schoolcraft is suggesting or rather stating that it has been said that by cutting a channel through, the rapids might be improved and thereby the channel be considerably improved for the purposes of navigation for boats of eight or ten tons burden. I think

1159 he says that it would be improved in that sentence.

Whereupon counsel for defendant replied:

"Does he? But he does say:

The Illinois in passing these rapids spreads over a wide surface and was reduced to a depth of a few inches, hence it has been said by cutting a channel in the rock so as to concentrate the volume a good and sufficient navigation would be afforded for boats of eight of ten tons burden?

I am speaking of the statement in that sentence," to which the witness replied:

"I know, but just in the sentence immediately following it does he not speak about improving the channel?"

Counsel for defendant answered:

"He does. But in that to which you referred as to 'a good and sufficient navigation would be afforded for boats of eight or ten tons burden' he was speaking of affording such navigation, was he not, in the sentence just preceding?"

Continuing the witness said:

"Similarly he says: 'The whole series of rapids could be improved.' That is in the succeeding sentence, but I thought you were not clipping me off to a single sentence."

1160 Whereupon counsel asked if it says anything about the navigation being improved, to which the witness replied:

"Why, yes, 'It is said by cutting a channel in the rock

so as to concentrate the volume a good and sufficient navigation would be afforded;' would be afforded for boats of eight or ten tons burden, and I have given the substance of that in my answer, or consider I have. It is a question of construction. I hold to my answer."

I assume from your reading that he says, after the portion which you have quoted, ending: "This would lengthen the portage to about thirty miles, but it has been perceived that we experienced difficulties far below this last mentioned point. This fact is sufficient to show the error of those who have supposed that a canal of only eight or ten miles would be necessary to provide navigation between Lake Michigan and the Illinois. As to whether, basing it upon what appears here and what we have just read previously, he is talking of navigation for boats of eight or ten tons burden, I should have to look at that before I arrive at such conclusion. On page 1050 he is giving his own opinion that a canal of only eight or ten miles would not suffice to provide nav-
1161 igation between Lake Michigan and the Illinois. On page 1051 he is reporting a statement made to him by some one person or persons about the advantages that might accrue from cutting through a channel to provide good and sufficient navigation for boats of eight or ten tons burden. I do not infer from this that in his remark he necessarily means boats of that size. He does not state what size he is providing navigation for.

In referring to Forsyth I said that in the absence of testimony to the contrary I should take his distances as being as accurate as that of any other data of that period which I could hope as a historical investigator to find. As to whether I would proceed, in the absence of testimony or in the absence of further research, to accept the statement of Forsyth as to distances, I will say if I were writing an article or making a note upon distances from the various portages I should gather all the testimony I could possibly find relative to that question. I would receive with much respect such testimony as comes to us through the Forsyth memorandum of distances, as being good contemporaneous testimony as far as it goes, but I should not be willing to accept it as an accurate statement without examining other data if it were possible to obtain such other data.

Supposing I had before me in the immediate matter under investigation other data giving the distance differently from what Forsyth gave them, I would check up to

see what was correct. I should suppose that it was—I could hardly say as to which was correct, because the experience of different people vary from year to year and season to season according to the stage of water. That is a matter of distances of portage. I had in mind distances of portage. I beg your pardon. Distances as computed by early travelers vary very greatly. These men did not start out with tape measure to measure their way along the streams. They judged by a thousand and one different conditions, the force of the current, the length of time it took them to make it, and any person who had ever journeyed upon rivers in a canoe will find all manner of statements among the inhabitants as to the distances between one spot and another. I have had much occasion to know that myself. I should not take as an absolute statement of fact the report of a
1163 certain man as to distances except in a general way, purely a general way. Forsyth says, page 220 of the record: "Distance from St. Louis to Peoria and from thence to different parts of the country as computed by travelers." I say at page 973 of the record it was apparently prepared for the convenience of travelers. I suppose I was unconsciously quoting the language that was on the memorandum. I should judge from the general condition and appearance of this manuscript, with which I am very familiar, that it was a pocket memorandum and that he computed his distances either from personal computation of those distances or from reports made to him by other travelers, or from both, and that it was prepared as a matter of convenience to himself; possibly for others who were connected with his Indian agency. As to whether as a matter of fact I have taken any pains to see whether it is accurate or not, I would say I have not. As to whether I have noticed that the distances he gives do not agree with those of Flint, I would say I have not compared them.

Q. Do you know as a matter of fact that taking, for instance, the distance from the forks of the Illinois covering this particular territory to Chicago, which is given as sixty miles, it is in reality about forty-six miles?

A. I do not, in my direct testimony at page 973, vouch for the distances as given by Forsyth. I have simply stated them as an interesting relic which has come down from the past and apparently honestly prepared.

Whereupon counsel for the government moved to strike out the answer and question on the ground that the ques-

tion is based upon a hypothesis which does not now exist, namely, the assumption by counsel for the defendant that the actual distance from Chicago to the mouth of the Desplaines river is forty-six miles, when as a matter
1165 of fact the distance is entirely different from that as the government will show at the proper time.

Dr. THWAITES (continuing): I did not notice that Forsyth gives the distance from the mouth of the Fox river to the forks of the Illinois at 42 miles, while Flint gives it at 30 miles. As to what I meant by the statement, referring to Long, that his report would be accepted by historians as conclusive, because of the fact that we have here an expert who was sent for the very purpose concerning which he is reporting, and it would be a dereliction of his duty had he made an untruthful report, I would say that the word "conclusive" as used by me on page 976, is as I look at it in cold type, a little stronger than the word which I might have used. It would be better to say that is it valuable testimony prepared under the circumstances that it was and by the man that it was. As to whether Long's report and Graham and Philips' report could not both be conclusive if they were directly conflicting, I should have to examine them side by side carefully to see whether they do conflict or not.

Q. But we assume for the purpose of this question that they do?

A. I do not like to answer no or yes to assumptions; I would like to see the documents.

1166 As to who I understand actually made the detailed investigation of this ground, Long or Graham and Philips, I could not state except by comparing the documents side by side. I am aware and stated in my direct testimony, transcript page 976, that Graham and Philips were sent here with the surveyor, Mr. Sullivan, for the purpose of making the survey of the land as ceded by the treaty of 1816. I do not find in the extract from the report of Major
1167 Stephen H. Long any statement that he actually made the survey; neither do I find such a statement in the report of Graham and Philips, from a rather cursory examination. In response to the first question I answered this afternoon, I introduced the fact that Graham and Philips' report was made in 1819, and that that was the driest recorded season. The date in 1819 that Graham and Philips made that report was the 4th of April. As to when they made

their survey, I do not find any evidence in the report as to when they made it.

As to whether it is clear that he made it before April, I would say the report being dated April 4 I should presume that might be taken for granted. As to whether, as a matter of fact, the survey was made at all in the dry year of
1168 1819, I would say I have no further evidence in regard to it than that before us. Being asked if I have any record that prior to April 1819, it was the driest season—known and that year was the driest season known, will say the only record I have relative to the dryness and low water in 1819 is the one cited from the Deep Waterway Commission's report. As to whether that shows anything to indicate that that season, April to April, on the Desplaines river was the driest season known, I would say it contains the words "The year 1819," and that is all I find.

Q. It does not refer to the Desplaines river, does it?

A. It refers to the lake levels which would seem to argue a very dry year.

Q. You will note that Darby was published in 1819 and that his trip was made in 1818. It contains a quotation from the St. Louis Enquirer which sets out that Graham and Philips, accompanied by Mr. Sullivan, the surveyor, had already set out to Lake Michigan. Is it still your impression that that survey was made in the year 1819?

A. Did I give it as my impression that the survey was made in 1819?

1169 Q. If not, I know of no reason why you introduced the fact that 1819 was the driest season of record.

A. The date of their report I cited, giving apparently the conditions obtaining at that time.

I should presume that they brought their report up to the date at which they signed their report.

Q. Don't you think it is rather a violent assumption from what you have seen in the government report that Professor Cooley handed you,—the assumption that prior to April, 1819, that 1819 was the driest season recorded?

A. I should presume that as 1819 is given as the date of the very lowest water known of record, as cited there, that that date of lowest water was the culmination of a series of very dry seasons.

Motion to strike out the answer as not responsive to the question.

As to whether there is anything in Child's report, page

981 of the record, of having come up with one person in a canoe and without sufficient provisions to supply his needs, to indicate that the Desplaines was a route of trade, I 1170 would say that on page 162 of the Wisconsin Historical Collections, Volume 4, Mr. Childs says that he was at St. Louis having proceeded to that town by the way of the Fox-Wisconsin trade route and the Mississippi river. He says:

> "I remained two weeks (meaning at St. Louis), did my business, when I was advised to return by way of the Illinois River."

The fact that he was advised to return by way of the Illinois river route is good evidence to my mind that the Illinois river route was a regular route of commerce and travel.

Now it is quite evident that Childs was not traveling in a large canoe. He had with him one Indian and one Frenchman to paddle his canoe. He apparently came up in a time of flood because he says that he came

> "upon the Eau Plaine where I supposed we had to make a portage to Chicago river, but I could not see any signs of the portage. There had been heavy rains for several days, which had so raised the streams that they overflowed their banks. I concluded that I had gone far enough for the portage, so I left Eau Plaine and took a northeast direction. After traveling a few miles, I found the current of the Chicago river. The whole country was inundated; I found not less than two feet of water all the way across the portage."

1171 As to whether there is anything to indicate that Childs on the trip from St. Louis to Chicago used the Desplaines river for any purpose of trade, I would say he used it for the purpose of travel. As to whether there is any indication that he used it for trade will say he was a business man had business at St. Louis and was on his return home. He was traveling as a commercial man. He does not seem to have had any cargo with him in his canoe.

As to whether the fact that the prairie was inundated and that the river was out of its bank is any indication that the prairie over which he passed was a route of trade or travel for boats, I should say certainly, except that it was an exceptionally good condition at that time. Admitting that as La Salle says and as many others, that for a couple of weeks in the spring the country is inundated in that neigh-

borhood, so that boats passed over it, of several tons, that in my judgment would establish it as a navigable route of trade or travel, during that period especially. I mean
1172 that when the country was flooded between the Chicago river and the Desplaines, as very frequently occurred upon other portage routes of a similar character, as for instance, the Fox-Wisconsin, travelers would regard the conditions obtaining at that time as especially favorable for purposes of navigation.

Q. That is what I desire. Do you understand then that a navigable stream is one which may at any season of the year, by reason of floods or otherwise, be traversed by boats bearing cargoes or passengers?

A. In the case of two streams approaching so closely together, with a well marked portage route existing between them, I should consider the condition of high water so that men could pass freely from one of these streams across the water shed into the other streams, a peculiarly favorable condition for purposes of navigation.

Motion to strike out answer as not responsive to the question.

Dr. THWAITES (continuing): As to whether, if it be true that for ten or fifteen days in the spring ordinarily the prairie between the Chicago river and the Desplaines
1173 river was flooded so that boats could pass and repass, I would consider that that prairie was a navigable stream, I should not say that the prairie itself was necessarily a navigable stream, but a river may be so overflowed that a man cannot see the exact course of the established river bed and that in conducting his navigation he might well occasionally carry his boat out over the edge of the stream, on what might ordinarily be a prairie. The facts in this case show that the whole country was inundated, in other words, under such conditions the river was much wider than it was generally, a condition pertaining quite generally upon rivers. As to whether on this particular occasion referred to by Childs the whole country was inundated, I would say that he says that the streams were raised so that they overflowed their banks. He used the words, "The whole country was inundated." As to whether I would say that from that that the whole country was a navigable river, I would
1174 reply he further says in the same sentence: "I found not less than two feet of water all across the portage," showing that he was following the portage and the stream

pretty closely. And yet he says he could not discover the portage and evidently did not know where he was until he struck the current of the Chicago river. As to whether as a matter of fact, if a man had gone to the Fox-Wisconsin in 1837 and 1838 he would have found a regular line of boats engaged in the carriage of the produce of the country, I would reply I do not think so. As early as 1838 there was a line of boats on the Fox river between Oshkosh and Green Bay. As to whether I find anywhere any record of any line of boats running on the Desplaines river, I would ask do you mean by a line of boats a line of boats that run on a certain
1176 schedule and carried passenger from point to point, because we might call the regular boats passing up and down the river a line of boats. If you have excluded those from your question, then I do not have sufficient knowledge of Illinois local history to say whether or not there was a line of boats advertised to take freight and passengers upon the Desplaines river at the period you mention. As to whether I have enough knowledge to know that there never was, I would say if you will allow me to speak from my general knowledge of the condition of the country at that time, I should say that it was quite improbable. As to whether I know that when the early settlers came into the new western country, wherever there was a river capable of sustaining any kind of a boat, a boat was built to navigate on that river to carry in the early settlers and carry out their produce, I would say I do not know that to be a fact. On rivers leading from the east to the west, like the Ohio and the Monongahela, and streams of that sort that were on the regular line of westward emigration, such boats were maintained at an early date; but the Desplaines river comes from the north toward the south, and until the period of sailing boats and steam packets there was not as heavy emigration towards the west, of early American pioneers by the way of the Great Lakes as there was by the way of the Ohio river.

Q. In view of your last preceding answer, how do you account for the fact that the Illinois, up to the head of navigation, was used by settlers both going down and coming up for the carriage of themselves and their produce, while from the head of navigation to Chicago they went invariably by wagon?

Objected to as not proper cross-examination, and, fur-

ther, because the hypothesis in the question assumes a state of fact which the evidence does not disclose.

A. I am not sufficiently versed in Illinois local history to be able to answer your question.

Q. If it is true that there is no record of any settler coming into the country by the Desplaines or carrying his produce out by the Desplaines, or his supplies in by the Desplaines, and I am speaking now from the time the first
1178 settlers came in and not the fur traders, but that the same class of settlers invariably used the Illinois up to a point above Ottawa, to come in and go out and carry their produce back and forth, how do you account for that fact unless it be because the one stream was navigable and the other was not?

Same objection.

A. Knowing so little of Illinois local history in general I should not wish to stake my reputation as a historical specialist in assuming a knowledge of early agricultural settlement of that region.

Q. The question did not require you to; I assume the hypothesis. You yourself have stated in regard to Lahontan that it was improbable that he would have gone overland when he might have gone up the river. Is it not equally improbable that the settlers would come in themselves by land and depend upon the land for the transportation of their farm products before there was a canal or railroad, if the Desplaines river had been navigable?

A. Properly to answer a question of that kind, Mr. Scott, I should have to make a special investigation of details of settlement in northern and northwestern Illinois, tracing where the settlers came from and how they entered the country in general; whether by wagons, we will say, overland
1179 from Detroit, or whether they came from the south by the rivers from the southern states, from Missouri and other southern states, and I have never made such a study.

Q. Assuming for the purposes of this question and for the purposes of your answer, that many of them came by water to Chicago and then walked or went by wagon overland to the places where they settled on the Desplaines river, does not the same reason that applied in Lahontan's case apply there, that if the river had been navigable they would not have taken it? I mean that you have applied to Lahontan's case.

Same objection as previously noted.

A. The settlers may have come by wagon from the east.

Q. No, I assume that they came by water in the question, to Chicago; that is the question.

A. And they might not have had their canoes and batteaux with them as the fur traders had, and therefore would not have had the means for navigating the Desplaines river and would have preferred to walk across the country. I should have to have a knowledge of all the factors in regard to that case before I could arrive at a conclusion concerning it.

Q. We will supply all of those factors to the court. How, then, do you account for the fact, and assume for the purpose of this question that it is a fact, that when they brought
1180 their produce and merchandise from St. Louis, the settlers brought it by boat up to Ottawa, and then by wagon the rest of the way?

Same objection.

A. I will make a general answer to queries of this character, that conclusions based on why settlers, early agricultural American settlers I mean, did this or that in regard to their method of entering the country, depend so much upon where the emigrants came from, the conditions under which they entered the country and all that sort of thing, that I should have to have a knowledge of Illinois local history, which I do not possess; and I am not willing to answer hypothetical questions when given to me with so many assumptions concerning facts and events about which I know nothing.

I was invited into this case to pass upon certain historical evidence that was laid before me, and to reach a conclusion concerning it, and there I must rest.

Q. In your conclusion on page 990, you brought in as suggesting a comparison, the condition of portage routes in other places during times of drought in this language: "That during times of drought such as often occurred in the summer and fall on most of the western portage routes between the Great Lakes and the Mississippi (as for instance, on the well known and much used Fox-Wisconsin portage route) the
1181 passage was sometimes difficult." Reserving for the present that language "sometimes difficult," do you wish to be understood that the difficulties of the Fox-Wisconsin in the summer were as great as those on the Desplaines?

A. I should say that under certain conditions in certain seasons upon the Fox-Wisconsin route, the conditions were frequently quite similar. May I be permitted to state some of those conditions in explanation of my answer?

Q. Yes, if they show that the difficulties were as great as

on the Deplaines; that is the question. If they do not I shall move to strike them out.

A. In Wisconsin Historical Collections, Volume 18, commencing at page 332, Peter Pond, a famous fur trader in his day, speaking of the Fox river in the year 1773, says that the track was very narrow: "It took the most of ye next day to get about three miles with our large Cannoes." Speaking of the windings of the Fox river he said: "We have to go two miles without geating fiftey yards ahead so winding." In regard to the portage he said: "In Wet Weather it is bad on account of the Mud & Water." In crossing the port-
1182 age on page 334 of that same volume, he says that the portage though only one and a half miles long took them two days of hard labor.

In St. Cosme's Narrative he praises the Fox river because "there were only three leagues of tapids."

In 1832 Colonel Charles Whittlessey, a prominent citizen of Detroit, in ascending the lower Fox in September as reported in Wisconsin Historical Collections, Volume 1, page 73, speaks of the four "considerable falls besides rapids," by which the river is obstructed, and continues in this language: "But the only communication for goods, provisions and so forth to the military and trading posts in that quarter is by the navigation of this stream." He speaks of the difficulties of pushing the boat in high water and says "in low water it is with difficulty a bark canoe will swim."

Now, let us refer to some of the difficulties on the very greatest of all the great portage routes, the route by the way of the Ottawa river and Lake Nipissing reaching over from the St. Lawrence river to Lake Huron. In the travels of Alexander Henry the Elder, Baines Edition, pages 18 to 34, Henry describes the portages and the difficulties of that route.

1183 Referring to the Fox-Wisconsin route, the season of the year that Peter Pond was talking about in the reference I refer to was September. I began with "the Rode so narrow that it took the cost of ye next day to get about three miles." The sentence begins as follows: "We incampt hear. Will not undertake to Cross til morning—the Water was two Deep to wade and ye Bottom Soft." I was reading from my notes. The account of the portage I referred to referred to the conditions of the portage in wet weather. It says "But in wet weather it is bad on account of the mud and water, which is two-thirds of a mile." As to weather

as a matter of fact, in spite of the difficulties, the Fox-Wisconsin portage was preferred by the traders over the one to Chicago, on account of the shortness of the carrying place, I would say that was a general conclusion. The traders who were operating toward the upper Mississippi used it. I know Dickson who is referred to in Volume 12 of the Wisconsin Historical Collection; Dickson was a very well known fur trader. I have cited St. Cosme that there were three
1185 leagues of rapids on the Fox, and I have cited this account of Ponds showing the portage of a mile and a half. As to how long I understand the portage at Chicago to be, I would say it varies very greatly according to the season, from two miles upwards. As to whether the portage of the Wisconsin, which they state was preferred because of its shortness included the rapids of three leagues, I would say they had to portage around the rapids on the lower Fox, besides making the portage between the Fox and Wisconsin. As to whether it is not a natural conclusion that the portage of Chicago which they sought to avoid was a portage of at least more than eleven miles, inasmuch as they preferred the Fox-Wisconsin portage, which aggregates at least that distance, I would say that around these, each one of these some half dozen rapids in the lower Fox river, between Lake
1186 Winnebago and Green Bay, they had what the French called decharges, or places where they unloaded their goods from their canoes or batteaux, as the case might be, where they unloaded their cargoes or the greater part of them, and transported them by land and dragged their boats. As to whether they could drag their boats in from the Fox on the lower Fox, I would say I should suppose that would depend upon the stage of the water. Certainly at some of them they would be able to drag their canoes at some seasons of the year when the water was not very high. You have another element coming in, however, the Wisconsin river below the portage which was filled with sand bars. I attempted once myself to canoe on the Wisconsin and I found my canoe stuck on a sand bar on an average of about ten times a day. That was very tiresome to some of the early traders.

Whereupon the question was re-read to the witness as follows: "Is it not a natural conclusion that the portage of Chicago which they sought to avoid, was a portage of at least more than 11 miles, in as much as they preferred

the Fox-Wisconsin portage, which aggregates at least that distance.

(Witness): I will ask you as to whether you mean
1187 by the question read, an aggregation of portages, not a portage of eleven miles; Dickson speaks of the portage at Chicago, and I take it from that he means all the portages probably that were involved in the route. The Fox river had a fall of 170 feet in 28 miles. As to whether it had a fall of 38 feet in two and a half miles, I am not sure as to that, but the general fall is about as stated.

Whereupon the witness was asked to read what he had stated about Whittlesey.

Whereupon the witness replied:

In the Wisconsin Historical collections, Volume 1, Colonel Charles Whittlesey, a prominent citizen of Detroit, is ascending the lower Fox river in September and uses this phraseology concerning it, or this description: "The river is obstructed by four considerable falls besides rapids, but the only communication for goods, provisions and so forth
1188 to the military and trading posts in that quarter is by navigation on this stream. At high water a small river boat of fifteen or twenty tons is pushed against the current until it comes to a fall." "The cargo is here taken out until the voyagers can force the craft up the rapid by main strength. In low water it is with difficulty a bark canoe will swim."

I spoke in my conclusion of most of the western portage routes having the same difficulties in time of drought, speaking with reference to the Desplaines, and taking the nearest of the well known portages. As to whether it is true that in times of drought the St. Joseph was taken to avoid the difficulties of the Desplaines, I would say that is rather too general a question for me to answer. I should not be willing to assume as a general conclusion that in dry seasons traders took the St. Joseph in preference to the Desplaines to avoid two long difficult carrying places. As to whether it is not true that the St. Joseph was navigable for batteaux for a very considerable distance in all stages of water, I would say Charlevoix in his letter of August 16, 1721, says of the navigation on the St. Joseph river, that the navigation of the twenty leagues between the mouth and the portage requires great precaution. Long's report, page 250 of
1189 the record, makes the statement made by counsel. La Salle (2 Margry, 127) describes the portage at St. Jo-

seph in low water as being two leagues. As to whether Tonty in August, 1680, found the portage at St. Joseph to be two leagues, I would ask where is that.

Q. That is Faulkner's Discovery of the Mississippi.

Objected to on the ground that the book is not produced so that the witness may examine it.

A. I do not know that book; at least if I ever knew it I have forgotten it. I have said that the passage was sometimes difficult over the Chicago-Desplaines route. From the authorities that have been brought to my attention I think that that is an accurate statement. As to whether it is true that the passage was at some times impossible if weight is to be given to the excerpts presented to me on my examination, I would say "impossible" is a very
1190 big word. Voyages between the lake and the Mississippi accompanied by portages of greatly varying lengths appear to have been made at almost every season of the year, according to my recollection. As to whether if the passages were impossible at certain seasons it would then be inaccurate and unscientific to say that they were sometimes difficult, and not to indicate in my conclusion that sometimes they could not be made at all, I would say that the difficulties, such as they were in dry seasons and in flood, appear to have been overcome by some travelers at almost every season of the year. What might appear to some people as impossibilities of passage might to others be overcome according to their hardihood. Aside from the Hubbard narrative, to refer to any trip made, except in the spring, where the difficulties seem to have been overcome and where the journey was made for trade purposes, I would say that Marquette and Joliet made the journey. They started out from the Arkansas river on the 17th of July, 1673, and they reached Green Bay at the end of September. As to whether he says one word about using the Desplaines river, I would say he said he used the Illinois river. He does not mention the Desplaines river by name. He is upon the Illinois river and he says that he went over to the
1191 Lake of the Illinois. He mentions the portage and tells that the portage is only half a league in the spring and during a part of the summer there is only one portage of half a league. He went by the Fox and down the Wisconsin
1192 in 1673. Coming back to the particular narrative referred to, where he says: "In the spring and during part of the summer, there is only one portage of half a league," the

portage there referred to is to the Illinois, below the site of Kaskaskia. In the passage referred to he said:

"One of the chiefs of this nation with his Indian men escorted us to the Lake of the Illinois whence at last at the end of September we reached the Bay des Puants, from which we had started in the beginning of June."

1193 As to whether outside of that sentence, above quoted, there is an indication how he went from old Kaskaskia to the Lake of the Illinois, I would say I do not remember anything. I have just examined the journey for the purpose of ascertaining that fact. Referring to the question:

"Aside from the Hubbard narrative, refer now to any trip made except in spring where the difficulties seem to have been overcome and where the journey was made for trade purposes?"

St. Cosmo made the trip in October. They made one portage of two leagues. He says they had four before them to Mount Juliet. Then he seems to infer, although not directly saying so, that there is a portage of seven leagues from Isle a la

1194 Cache to Monjolly. Then after Monjolly they made a portage of two leagues and then they came to another little portage of a quarter of a league and so on. There seems to have been several other little portages along the way. Speaking of the Chicago portage, proper in which I presume he is referring to the south branch and Mud Lake or thereabouts, he says: "It is about three leagues long when the water is low, and only a quarter of a league in the spring." In speaking of the distance between Isle a la Cache and Monjolly, he says: "There is no water in the river except in the spring." As to whether, if I added up the portages that he describes as having been made there, I know how much the Desplaines river would be left unportaged, I would say I never figured it up. As to whether in that achievement they carried only such baggage as was absolutely necessary for their voyage, I should say I should hope they were sufficiently cautious to do so. I would have to look at the book to see. If

1195 they were good travelers they would carry just as little as possible, and I will assume they carried just as little as possible. It seems to be a fair statement that they carried only such baggage as was absolutely necessary for their voyage, making a cache of their effects for the reason that the waters were extremely low. As to whether they portaged more than half the way down the Desplaines river, I would say I have not figured up the distance. As to whether I would

consider that accomplishing the passage of the river, I would say when I consider the difficulties on same of the other portages, I should say that these difficulties which they overcame were no greater than such as voyageurs and travelers had frequently to overcome on other portage routes.

Q. I will undertake to say, Dr. Thwaites, that you will find none in a river of this length where the portages were so considerable, who still call the river navigable.

1196 Mr. CRESSY. I object to the remarks of counsel for the defendant and move that they be stricken from the record.

Dr. THWAITES continues, and says:

As to other instances of use of the river for purposes of trade, not in the spring and outside of Hubbard, I cannot state them without investigation. It would take time for me to prepare a tabular list.

As to whether it would be necessary, to justify the conclusion that the passage was at all seasons of the year possible, although sometimes difficult, to reject the statement of Long that the Plein during half of the year does not contain water enough to float a boat, I would reply that Mr. Long does

1197 not state that the entire length of the Plein has no water. His statement that the Plein during half of the year does not contain water enough to float a boat is a generalized statement. It might not obtain over the entire Plein. Even were it true that the entire length of the Plein did not contain water enough to float a boat at this season referred to, the length of the portage I should not consider an absolutely insuperable barrier which enterprising fur traders could not surmount by means of portage. I mean that fur traders, if they were put to it under extraordinary conditions and excessively low water would, taking into consideration the difficulties which they had in getting up to the head of Lake Michigan from the lower St. Lawrence and the various portages upon the way,—would not regard that as an insuperable barrier to the transportation of their goods.

As to whether I think that the absence of water would be an insuperable obstacle to a voyage down the river, I would say that there might be occasions when the boats which they used, canoes, batteaux, pirogues, whatever it might be, might be dragged or pulled during a very low stage of water, over a considerable distance, and yet the cargoes or a greater part of the cargoes be transported by land. That would be what the French fur traders would call a decharge, a discharge.

1198 Before proceeding, Mr. Scott, I should like to have you point out to me the passage in Long's report in which you state that Long says "there is no water in the Desplaines for half the year."

Whereupon the following passage was read by counsel for defendant.

> "Supposing that evil remedied by a lock to lift vessels into the Plein, yet the Plein during half the year does not contain water enough to float a boat and so could not become useful as a national highway."

After some colloquy, the original question was reread, as follows:

1199 "Docter, in order to justify the conclusion at which you have arrived, which indicates that the passage was at all seasons of the year possible, although sometimes difficult, it would be necessary, would it not, to reject the statement of Long that the Plein during half the year does not contain water enough to float a boat?"

Whereupon counsel for the defendant stated that this was an error—it should have been Graham and Philips.

Dr. THWAITES continued:

My answer was based upon the supposition that it was Long. The passage in Long which I did not read at the time is on page 17 of this pamphlet. It is as follows:

> "To render the Desplaines and Illinois navigable for small boats and flats requiring but a small draught of water, nothing more is necessary than the construction of sluices in a few places where there are ripples of a sufficient width to admit the boats to pass through them.
> 1200 This may be effected by clearing away the loose stones from the bottom and forming banks riveted with stone two or three feet high, on each side of the sluice. Thus, a water communication between the Illinois and Lake Michigan may be kept open at all times sufficient to answer all the purposes for which a canal will be wanted, for many years to come."

Now my reply to you was upon the assumption that Long was making this statement and you so stated to me. That being the case, and you now stating that that statement is not in Long, that there is not water enough in the Plein during half the year to float a boat, I would like to withdraw my entire answer to your question.

Q. Would it make any difference in your answer whether the statement was made by Long concerning whom there is no

statement that he made the survey, or by Graham and Philips who with Sullivan appear to have made the survey?

A. Upon a rereading of Graham and Philips' statement I beg leave to quote on page 17 the entire statement made by Graham and Philips beginning:

> "2d. Supposing that evil (meaning the evil of low water) remedied by a lock to lift vessels into the Plein, yet the Plein, during half the year, does not contain water enough to float a boat, and so could not become useful as a national highway."

Now, my interpretation of this is that he has clearly in view vessels so large in draft that they would require a lock, and not vessels that were ordinarily used in the fur trade communication.

1201 Motion to strike out the answer as not responsive to the question.

The witness continues:

I am further confirmed in this interpretation of Graham and Philips report by the fact that a little later on he suggests a canal "from a point in the lake south of Chicago to enter the Plein below Mount Juliet, at or near what is called Lake Du Page, but which is only a dilation of the waters of the Plein."

> "This route would lay over level prairie, through a multitude of small lakes, or ponds, which have neither name or place in any map. 2d. By a canal leaving the lake near its sound end, and uniting with the Theakiki just above its confluence with the Plein. Both of these canals would be fed from the lake, would require few or no locks, would go over ground of the same sort, would be 50 or 60 miles long, and would join the waters of the Illinois at points from which it is constantly navigable."

He states that the canal referred to would be 50 or 60 miles long, but the point that interests me is that from below
1202 Mount Juliet he declares the Illinois constantly navigable. He cuts out in the place you refer to the Plein entirely and unites with the Kankakee, but, in referring to the canal between the lake south of Chicago and the lake below Mount Juliet, he says that thenceforth the "route would lay over a level prairie through a multitude of small lakes or ponds." He does not say "thenceforth." I infer that
1203 he means by this term "level prairie," the region between the lake south of Chicago and the portion of the Plein below Mount Juliet. If he entered the Plein at or near what is called Lake Du Page, I do not know how much of the Des-

plaines river he would use, without consulting the map. As to whether the point indicated would be below Joliet will say I am not familiar with the survey maps of the Desplaines. That is an engineering question, and I do not care to be catechised with regard to it. I do not know, if he tapped with his canal, the Desplaines river at Lake Du Page which is below where the Du Page enters into the Desplaines, he would eliminate 43½ miles of the river between Riverside and the Illinois, leaving one and a half mile. In a general way I know where Lake Du Page is. To determine whether it is about a mile and a half above the Desplaines river, I should have to look at a detail map of Illinois to refresh my memory.

1204 Q. If that be true, then this proposed canal that you speak of practically eliminates the Desplaines river, does it not?

A. The particular point that interests me in Graham and Philips' report is his suggestion of a lock to life vessels into the Plein, conveying to my mind the idea that he has in view a larger vessel than that ordinarily used in the fur trade to which my attention has been drawn on my direct testimony.

Motion to strike out the answer as not responsive to the question.

Q. Now, Doctor, referring back to your answer to my question as to whether you could make a voyage down a river that had no water in it, would it make any difference to your answer whether Graham and Philips said that the river had no water in it, or whether Long said it?

A. But I do not consider that Graham and Philips' report refers necessarily to the kind of boat by means of which the fur trade, which was the principal commerce in early days, was conducted over these waters, but that they had in mind a much heavier boat.

Motion to strike out the answer as not responsive to the question.

Q. Now, referring to Hubbard and his account of the
1205 fur trade, first let me ask you if you know what the draft of those boats was?

A Yes, sir, I do. They were the kind of boats as I understand it, that the fur traders of those early times were in the habit of using in navigating the Great Lakes and the interior waters of the continent, and Schoolcraft in his Narrative Journal published at Albany in 1851, pages 68 to 70, says that a northern canoe, as he calls it, was 35 feet long by 6 feet wide and capable of carrying four tons.

Alexander Henry, the Elder, Bain's Edition, pages 13 to 15, says that they were five and a half fathoms long, or 33 feet, by 4½ feet wide, and worked by paddles and occasionally a sail. To each canoe, he says, there was a crew of eight men and the freight consisted of sixty pieces of 100 pounds each, and in addition there were the provisions of about a thousand pounds, the weight of the eight men, and each man was entitled to forty pounds of personal baggage, in all averaging about four tons.

There were various kinds of boats used on these western waters, of varying sizes. There was the pirogue for instance, concerning which my distinguished friend and colleague, Professor McLaughlin, said he was not informed, but I find in James Hall, in his Notes on the Western States as quoted in the Century Dictionary, an interesting description of the pirogue in which he says:

1206 "The earliest improvement upon the canoe was the Pirogue, an invention of the whites. Like the canoe, this is hewed out of the solid log; the difference is that the pirogue has greater width and capacity, and is composed of several pieces of timber—as if the canoe was sawed in two equal sections and a broad flat piece of timber inserted in the middle, so as to give greater breadth of beam to the vessel."

Lewis and Clark had two of these pirogues upon their journey up the Missouri and down the Columbia in 1804 to 1806. One was manned by six, and another by seven oars. They were declared to be equal to the Mackinaw boats. The Mackinaw boats which were frequently used in this western country as cited by Wheeler in his book called "The Trail of Lewis and Clark."

The page of the citation from James Hall's Notes is, Notes on the Western States, 1838, page 218. The citation from Wheeler in his book called "On the Trail of Lewis and Clark," volume 1, page 138, where he says they were forty or fifty feet long, flat bottomed, twelve feet wide, three or four feet depth of hold, and that these Mackinaw boats were light,

strong, open boats much used on the upper Missouri and
1207 subsidiary streams.

The batteaux were larger than the pirogues. The Canadian batteaux, and in my reference to this I do not seem to have given the page, but I will state it as having been one of the notes that I have gotten up for another purpose, and there I have found, although I am not able to give cita-

tion directly, that they were thirty feet long, eight feet wide, flat bottomed, pointed bow and stern, rowed with six oars.

The Durham boats are described in my Early Western Travels, Volume 9, in a note on page 323, as being heavy freight craft, built along the lines of an indian canoe. They were designed about the year 1750 by Robert Durham, of
1208 Bucks County, Pennsylvania. The ordinary Durham boat was sixty feet long, either feet wide, two feet deep. Had a capacity of about 15 tons and drew twenty inches of water. These boats of which I speak were of the sort that they navigated the Great Lakes with. May I mention the value of the load of one of these boats?

Q. Not in response to my question.

Whereupon counsel for defendant moved to strike out the entire answer as not responsive to the question.

Mr. WILKERSON. In order that it will not be necessary to repeat the matter in the record, you may treat the statement of the witness as to these different kinds of boats as if it were a part of the direct examination, so as to lose none of your rights of cross-examination.

Mr. SCOTT. Very well, then, we will consider that this is not given as part of the cross-examination, but upon direct examination. I will ask that the question now be read.

Question read.

Q. The question simply is if you know what the draft of the boat used by Hubbard in the fur trade was?

1209 A. Not by Hubbard, but the entire boats that were used in the fur trade.

Q. Now, treating that as part of your direct evidence, is it your opinion that a boat like the Durnham boat you have described, could navigate a river even in April, in all years, when according to the gauges regularly taken by engineers in some years for many days in April there was no perceptible flow of water in the Desplaines river?

A. In the trip which Hubbard took going down over the Chicago-Desplaines waterway in October, 1818, I do not find any evidences that they took their boats out of the water, although sometimes they did unload the goods from the boats. He speaks upon page 40 of the manner in which they pushed the boats along; "four men only remained in a boat and pushed with these poles, while six or eight others waded in the mud alongside, and by united efforts constantly jerking it along, so that from early dawn to dark we succeeded only in passing a part of our boats through the Aux Plaines outlet,

where we found the first hard ground," which would seem to indicate that they did struggle along with their boats.

1210 Motion to strike out the answer as not responsive to the question.

Whereupon a colloquy ensued between the witness and counsel as to the meaning of the question.

1211 Dr. THWAITES continues:

There are lakes in the river, as I understand it. I know Mount Juliet used to have a lake in it. There was Lake Du Page.

Q. What else?

A I should like to look at a map of the river. I simply can state from my general knowledge of the difficulties through which these poor voyageurs went, that they could manage to wiggle their boats through some mighty difficult places.

Motion to strike out the answer as not responsive to the question.

Counsel says that at page 960 of my testimony I testified that I did not find in this detailed account by Hubbard any evidence that the fur traders were obliged to take the boats from the water in these passages.

As to whether, as a matter of fact, I have found but one detailed account by Hubbard of any one of these passages down the river, I would say that in 1821 in the autumn, commencing at page 104 of Hubbard, according to my reading of Hubbard's Journal, he seems to be going down the river.

1212 I thought the instance you referred to was in 1818. As to whether in the period from 1816 to 1824 I find any more than one instance of a detailed account of the passage of Hubbard down the river, I would say that in October, 1818, he went down the river as recorded on pages 32, 40 and 41 of Hubbard. In 1821 in the autumn he went down, commencing at page 104. These two accounts are sufficiently detailed to inform the reader that he went down and he tells more or less about it on each occasion. As to whether I can mention any case except one where he gives any detailed account of any trip down the Desplaines will say "detail" is a purely relative term. How many lines do you require for detail? That

1213 is, lines of description? He tells about his trip. I have cited you to two or three trips. I want to know which one of these two or three you refer to when you say he does not state the details in any case but one.

Q. Tell me which are the two or three you have cited where he gives an account with any detail of his trip down the Des-

plaines river other than the one, beginning on page 39, where, on page 43 he says:

"Most of the distance to the Illinois River our goods were carried on our backs, while our lightened boats were pulled over the shallow places, often being compelled to place poles under them, and on these drag them over the rocks and shoals."

As to whether I have in mind or not the notes which lie before me and which I am consulting any other account in any detail of any trip down the Desplaines river, I would call your attention to the account on page 105 of Hubbards, where he says:

"Having completed the portage to the Desplaines and
1214 encountered the usual fatigues in descending that river without unusual delay or accident we reached Bureau Station, where I had passed my first winter."

I thought your question was whether there was any detailed narrative relative to his going down over that route. As to whether I consider that a detailed account of how he went down the Desplaines river will say he gives seven lines to an account of that trip. He does not speak specifically of the trials and tribulations of the Desplaines river because he has already mentioned them I suppose at a previous page. Being asked if it is not a fact that he does not give any description of those trials or how far he had to portage or how far he had to carry the goods, will say he gives seven lines to a description of his trip and all he says is the two lines I have just read relative to the Desplaines. Being asked to name any other account where he gives the details of his trip down the Desplaines river, on page 121 he is going down the river and summarizes his difficulties by saying "The usual trials and hardships." There is not very much detail in there but it is very suggestive.

1215 As to whether I have any other reference that I think would show a detailed account of his trip down the Desplaines, will say his other accounts of his passage upon the Chicago-Desplaines waterway are brief, very brief, but to my mind sufficiently descriptive as to indicate what he was doing.

Q. Indicate one or more than those three you have already given?

A. I did not say going down, I said his voyage upon the river.

Motion to strike out the answer as not responsive to the question.

1216 I have no other detailed report of his going down the river.

Counsel states that I have therefore given one in which he gives the detail showing it was necessary to carry their goods on their backs from Isle a la Cache, and two where he refers to the usual trials and hardships, and asks if that is the sum of his detailed narrative of his difficulties of going down the river.

There was a third one in 1821 where he spoke of the usual fatigues.

Being asked if because of one narrative where he gives details, and where they were carrying their merchandise on their backs from Isle a la Cache to the river, I assume when he says the usual trials, in the other accounts, that he meant the same thing, would say he might mean either his own old experiences or the usual fatigues that were common to traders along that route.

As to whether he might mean that they were required to take wagons, as it appears from Schoolcraft that traders were doing during this same period for at least thirty miles,

1217 will say I do not find in Hubbard that he mentions wagons.

Being asked if I recall Schoolcraft's writing during this same period that he met traders carrying their boats on wagons down near Lake Joliet, will say that from the fact that Mr. Hubbard seems to have taken his boats with him and pushed them along there, I infer that when he speaks of usual fatigues, he means the fatigues incident to that mode of travel.

As to whether I have any reason to believe that Hubbard met with any less trouble than other traders who, during the same period, were compelled to use wagons for at least thirty miles, will say I infer that Mr. Hubbard met with the trials and hardships, whatever they may have been, which were suffered by his contemporaries in the fur trade over this route. I said there is not in this detailed account any evidence that Mr. Hubbard was obliged to take the boats from the water in these passages, but that they were at times forced to use poles to get them over the rocks and shallows. As to

1218 whether there is no evidence but that they might have been compelled on some of these trips, aside from this one in which he gives a detailed account, to take their boats from the river, will say I do not recall any passage from

Hubbard wherein he says that he was obliged to take his boats from the water. As to whether there is no evidence that he was not obliged to in some of the trips in which no detailed account is given, I would say I prefer to consider or to interpret the positive evidence given in Hubbard, rather than to consider the negative assumption that he may possibly have done otherwise.

Counsel says that what he is asking me is whether there is any evidence that Hubbard was not required on some of these passages to take the boats out of the water and transport them by land.

I have only the evidence of Hubbard as contained in his book. I have no other evidence concerning his movements.

I recall no evidence contained in his book that he did not, on some of these passages, take the boats out of the water and carry them by land. As to whether I know what the state

of the water must have been in order to take the boats
1219 from the Chicago river to the Desplaines without carrying them; the height of water to overcome a difference of eight feet between the Chicago and Desplaines rivers, assuming that eight feet was the difference in level between the Chicago and Desplaines at the place of the portage, would say it would mean a great deal of hard work pulling and hauling, as indicated in Mr. Hubbard that that is what they did. The boats were placed upon short rollers, he says. I do not know how far a man might propel a boat or at least push a boat on short rollers on shore. I suppose he might push it a considerable distance.

Being asked if as long as the drought held out they could navigate the land that way, will say I have gone around by rollers, around portages in that way and I know how hard it is.

As to whether as a matter of fact it is true that the Desplaines river, at the points where he says he was compelled to carry, is full of boulders and rocks which make it impossible to take a boat of the character he mentions there loaded through, or to take it through any way except by the use of poles and rollers, will say I do not know anything about those conditions.

1220 Q. Now, the fact of Hubbard is this, is it not, and of the fur trade carried on from 1816 to 1824, that during that period they went down at seasons in the autumn with evident difficulties; that it is not clear how far the men operating the boats were compelled to carry their freight and mer-

chandise on those trips except in one instance where they were required to carry from Isle a la Cache to the Illi-
1221 nois river, that in some fashion they continued to get their boats during those eight years from Lake Michigan to the Illinois River; that during that period Hubbard, who, through some relative of his, and when about eighty years old, made this narrative, urged upon his commander, Deschamps, to abandon the river entirely; that as soon as Hubbard came in position to follow his own judgment he did abandon the river and pursued the policy he had advocated with Deschamps, which was to bury the boats in the morass at Chicago and do his carrying overland. Is not that a fair summary of this whole attempt to use the Desplaines river by boats for the fur trade as carried on by Hubbard?

A. I do not consider, Mr. Scott, that that is exactly a fair analysis of Mr. Hubbard's purpose. On page 136 he says that his purpose was in unloading the boats, and so forth, to avoid "the long, tedious and difficult passage through Mud Lake into and down the Desplaines," and thereafter take the goods "directly to the Indians at their hunting grounds, instead of having to be carried in packs on the backs of the men."

Now, my understanding of this is that he was going to carry out a new policy. Instead of establishing, as he had heretofore when under Deschamps, subsidiary posts, that thereafter his men would go direct to the Indians from
1222 Chicago peddler fashion, carrying the goods on their backs. He says, "And go directly to the Indians from Chicago." That is the way I interpret that passage. That was an experiment carried on by some fur traders; that is my interpretation. He had been operating, as I remember, along the Iroquois and he had reached the Iroquois over the Chicago-Desplaines portage, and his proposition, as I understand it, is to avoid that roundabout passage and its difficulties, and attempt to reach the Indians directly from Chicago. The Indians in 1824 were upon the various rivers of Northern Illinois.

As to whether, as a matter of necessity to reach the Indians he would go generally down the valley of the Desplaines, I would say, I presume that in carrying out his goods
1223 to the Indians in this direct method that I have inferred he was engaged in prosecuting, he would use horses; but I find on page 140, all the same, that he made a trip down in a canoe to Peoria Lake from Chicago. On that trip

there is no indication that he was carrying merchandise or doing any trading. It does indicate he was still doing business on the Illinois river at Peoria. If he had business on the Illinois, the direct route would be the Desplaines river. I am not quite so certain that he abandoned it, but if you will note, commencing on page 140 he is at Chicago and he goes down in a canoe with an old Frenchman, making
1224 the trip in three days to Peoria Lake. There he is joined by his men; he does not say where the men came from, but from some one of his posts doubtless up in the country. Then they went to St. Louis and, turning over to page 141, you find that he arrived there in due season; that he bought his goods; then he said, "I bought my goods, delivered them at Chicago, and returned as quickly as possible to my post at Iroquois." He does not say directly how he got those goods to Chicago, but I think it fair to assume that he returned with those goods from St. Louis to Chicago by boat, though he had already carried out the project which he had determined on and long urged on Deschamps of carrying goods overland.

As to whether it is the true significance of that passage that when he got to the navigable waters of the Illinois he used boats, as all men did in those days where they could find a river that was navigable, but up to that point he had determined to discard the Desplaines and not use boats—I would say, the fact that he went down in a canoe from Chicago to Peoria Lake and there on Peoria Lake met his men and then prepared a boat for a trip to St. Louis, may readily have been that he preferred the lighter mode of conveyance between Chicago and the point where his men were to meet him, when of course a larger load would have been required.

Q. Now, getting back to your original interpretation
1225 or criticism of my summary, it now appears clearly, does it not, that he was engaged in business on the Illinois river as far south as Peoria; that from there to St. Louis he used boats, and therefore his reason for abandoning the Desplaines river was not to go directly to Indians at posts, but because though the Desplaines was the natural avenue by which to reach his post on the Illinois river, if practical, yet because as he says of the long, tedious and difficult passage through Mud Lake, into and down the Desplaines river, he abandoned that part of the so-called water route and resumed it when he came to the navigable waters of the Illinois?

Here follows colloquy between witness and counsel,

whereupon the said question was again read, at the request of witness.

1226 A. Your question, Mr. Scott, proceeds upon a major premise, and that is that he was engaged in business on the Illinois as far south as Peoria. I call your attention to the fact that he simply appointed a rendezvous on Peoria Lake with some of his men. He does not state that he was engaged in business upon the Illinois river as far south as Peoria.

As to whether I know that he had at that time a post at Bureau, I would reply, certainly at one time in his career, I am not sure whether it was as late as this, he seems to have had a post at Bureau and a post at Iroquois. On page 125 it states that in 1823 he had a post at Hennepin. There is nothing to indicate that between this and 1824 when he carried out the project he had urged upon the Deschamps that that post had been abandoned, but that does not alter my interpretation of the passage that therein he did not speak of it. I do not know that he abandoned it.

1227 Hennepin was near Starved Rock.

Q. One of your grounds for rejecting Lahontan's narrative of the portage from the Illinois river to Lake Michigan was that if there were, and you assumed that there was, a navigable stream, he would not at that period of the year have gone over the soggy prairies, I think soggy was the word you used—do you know any reason why, if that were true of Lahontan, there could be any reason why Hubbard, for the purposes of trade, would go over these same prairies in the spring if the Desplaines river afforded a navigable route?

A. I give it up.

Re-direct Examination by Mr. Cressy.

1228 Turning to page 138 of Hubbard, to which my attention is called with reference to a note at the foot of that page entitled "Hubbard's Trail," this foot note reads as follows:

"Note—'Hubbard's Trail' ran through Cook, Will, Kankakee, Iroquois and Vermillion Counties, passing the present towns of Blue Island, Homewood, Bloom, Crete, Grant, Momence, Beaverville, Iroquois, Hoopeston, and Myersville to Danville, and southwest through Vermillion and Champaign Counties to Bement in Platt Coun-

ty; thence south through Moultrie and Shelby counties to Blue Point in Effingham County. At Crete, a fence has been built around a portion of this 'trail', to further preserve it as an old landmark and a relic of early roads and early times.—H. E. H."

Referring to the post at Hennepin, the last mention of that is 1823, which appears on page 125 of this book. As to whether there is anything to indicate that after 1824, when he established the so called "Hubbard's Trail," he continued the post at either Bureau or Hennepin, I would say, there appears to have been a cessation of a good share of his Illinois activities, I should judge, after 1824. He spent the winter
of 1825 at his Iroquois post and then apparently as if it
1229 were the succeeding summer, on page 143, he leaves the employment of the American Fur Company and makes his headquarters for the succeeding winter at the Iroquois post, although he made short excursions to other points. Then during 1827 and 1828 he does not seem to have done business as far as I can see. I do not find any account in the records for 1826 and 1827 about his trade.

Q. Turn to page 137 again, doctor, to the passage which says: "I now extended it south from Danville and north to Chicago, thus fully opening 'Hubbard's Trail' from Chicago to a point about one hundred and fifty miles south of Danville. Along this 'trail' I established trading posts forty to fifty miles apart." Would it not be a fair assumption from this passage that his posts that he had charge of were from that time forward along his Hubbard's Trail and not along the Desplaines river and the Illinois river?

Objected to as leading.

A. I should consider it a fair assumption.

As to what evidence there is that there was a fort or the remains of a fort at the present site of the City of Chi-
1230 cago, in year 1697, I would say that in the year 1697 Mantet and Louvigny, French military commandants of posts in the Northwest, presented a petition to the French minister of the marine in Paris, who had charge of the affairs of New France, to be allowed to make a trading voyage towards Mexico. This document is contained in Margry, Volume 4, at page 9. In the official heading to that document Mantet is styled "Former Commandant at Chicago." He asked to be granted "the post of Chicago which is the passage to enter into the river of the Mississippi."

Cadillac, in his Memoir, already cited in my direct testimony, page 896, uses this phrase, describing conditions in the Northwest: "The post of Chicago comes next."

In the Cadillac papers in the Michigan Pioneer and Historical Collections, Volume 33, page 75, Champigny complained to the authorities in 1697 in these words: "Sr. de Liette, a subordinate officer of the troops, cousin of the Sr. de Tonty, commands at the post of Chicago in the country of the Miamis."

I find further reference to this fact in Volume 2 of
1231 Laws and Treaties, Indian Affairs. In the Treaty of Greenville, of 1795, with the Wyandots and other Northwestern tribes, toward the bottom of page 40 (Vol. 2, Laws and Treaties, Indian Affairs), among the cessions of particular tracts of land to be made by the Indians to the United States, it says:

> "(14) One piece of land six miles square at the mouth of the Chikago River, emptying into the South-west end of Lake Michigan, where a fort formerly stood."

Turning to the Board of Trade Report, which appears in Volume 19 of the Michigan Pioneer and Historical Collections, page 5, where appears the passage, "Thence 150 leagues on the lake to Fort Miami situated at the mouth of the river Chicagou," I think that the author of this report doubtless had in mind the fort formerly situated among the Miamis or a branch thereof, the Ouistanons, situated at the mouth of the river Chicago, in accordance with the testimony I have just given. Referring to the account of LaSource, which appears in Shea's Early Voyages, I would say, by way of analy-
sis, that LaSource, whose narrative is before me, was a
1232 companion of St. Cosme upon the expedition which that priest and his companions under the guidance of de Tonty made from the great lakes toward Arkansas. It is a curiously disconnected, discursive account. The author jumps back and forth with the greatest facility between Chicago and the Arkansas. I consider it absolutely impossible for any person reading this report to know where in the world LaSource and his companions were at any given time or as to what they were doing. As, for instance, this sentence: "We were a strong party and going up the Illinois river we came near being plundered by the Miamis. They boasted that they would rob us as we came up the Illinois river. We are not in the humour of letting ourselves be plundered. We are thirty men to defend the river of the Illinois. There are as

many people at the Tamarois (Cahokia) as at Kebeq. Mr. de St. Cosme is at the Tamarois (Cahokia), which is eight leagues from the Illinois. It is the largest village that we have seen. There are about 300 cabins there. We arrived on Maundy Thursday at Chicagou after making thirty leagues by land. It rained during the last two days of our march."

If we look at this interesting narrative we discover in the first place that they are going up the Illinois river expecting to be plundered by the Miamis. Then in a line or two further down "they are thirty men defending the river of the Illinois." Then in the next line, he is telling us
1233 about the condition and number of the population at Cahokia. Then in a line or two further they are at Chicago which he says they reached from Cahokia by land.

In so confused and kaleidoscopic a narrative as this I should consider it practically impossible for any person to figure out anything whatever about it.

Turning to my edition of Lahontan, page 207, foot note 1, part of which foot note was read in evidence on my cross-examination, the entire foot note reads as follows:

> "If Lahontan had really been at Tonty's fort on the Illinois, he would have known better than to call it Fort Crevecoeur. The latter was the fort built near the site of Peoria, Ill., on La Salle's first journey to Illinois, and destroyed by mutineering soldiers two months later (Jan.-March, 1680). Tonty was at this time in command at Fort St. Louis, built (1682) on 'Le Rocher' farther up the river near the present Utica. For its later history see p. 133, note 1, ante. Lahontan probably intended to say that Tonty was respected and honored by the Illinois, not the Iroquois, against whom he waged frequent wars.—Ed."

I am the author of that foot note.

1234 In speaking of the Forsyth manuscript on cross-examination I used the words "interesting relic." I mean by the word "relic" an article that had come down to us from the past. I used the word "relic" in the technical sense commonly used by historians. We often speak of a manuscript or something contemporary of that sort as an interesting relic that has come down to us from the past. I did not mean a museum specimen, if that is what you mean to suppose. Considering the question as to whether Marquette made use of the Desplaines river in his voyage back from

Arkansas, I would say I have before me the map appearing in Jesuit Relations, volume 55, opposite page 154, commonly called Thevenot's map of 1681, which was published by him as being that of Marquette. This is a map which historians generally consider to have been based upon information emanating from that expedition of Joliet and Marquette
1235 in 1673. Upon this map there is a clearly defined representation of the Chicago-Desplaines portage with a dotted line reaching up to and through this method of communication between the mouth of the Chicago river and Green Bay. There is no representation upon this map of the St. Joseph-Kankakee portage, but of the Fox-Wisconsin very plainly made, over which Marquette and Joliet proceeded in their voyage; and of the Illinois and Desplaines, the Chicago route by which historians generally concede that Marquette returned to Lake Michigan. I find a dotted line on that map which is marked "Chemin du retour," meaning "road of the return, or return route." It seems to strike in from the Mississippi up to some point on the Illinois; then apparently loses itself in the stream and emerges at the mouth of Chicago river, and then proceeds northward along the west shore of Lake Michigan toward Green Bay. It will be fair to assume that from the point at which it merges with the Illinois river to the point where it emerges from the Chicago river that it passes up the Illinois and what is shown as perhaps the Desplaines, and then through a small lake marked "portage" and then down the Chicago river to its mouth.
1236 That is the judgment which I would arrive at upon examination of the map. As to why it is that we do not have more accounts of the use of the Desplaines river by travelers or traders, I would say that I can only reply to your question, Mr. Cressy, out of my general knowledge of conditions, the result of a considerable period of time spent in studying this region, especially during the French regime.

The grand majority of the men who were traveling upon the fur trade or as military expeditions, and so on, through this northwestern country in the early days were not men who were in the habit of making records of any sort. The most frequent of all the travelers during the French regime were that class of men called coureur de bois, or wood rangers, unlicensed fur traders who were rowing all through this country, and who because they were liable to severe punishment because they were trading through the western country without a license from New France, found it greatly to their ad-

vantage not to make records or to send out reports concerning their wanderings. It is only now and then that we get little glimpses, occasional references, perhaps, in the reports
of missionaries or in letters or reports that have come
1237 down to us from military officers and so forth, concerning the presence or the wandering of these coureurs de bois. But a sufficient number of documentary references have come down to us from the past concerning this very large and enterprising and far-wandering body of men to give us a pretty good notion of where they were and what they were at, their methods, their life, and so forth.

The Jesuit missionaries were of course men who were obliged under the rules of the Society of Jesus to make reports, to take observations, to send in their reports regularly to their superior officers in Quebec, by whom they were synopsized and forwarded to the general officers in Paris; and this is the reason that we have that great body of information concerning the west that is embodied in the collections known as the Jesuit Relations and Allied Documents.

Relative to military affairs in the west we are only just beginning to get good returns from the various archives of the French in Paris. Considerable quantities of documents have been printed through various channels, such as Margry, New York Colonial Documents, publications of the Michigan, Illinois, and Wisconsin historical societies, and so forth; and yet there is a vast amount of material that we have not yet got at, and the American Historical Association is now engaged in making what they hope will be a complete
1238 sweep of the archives of France relative to the period of the French regime in North America. The skeleton of western history has already been built up, although considerable portions of that skeleton have not been produced until quite recent years. Indeed, much of it within the last two or three years.

When we come down to the period of the British fur trade operations we find a somewhat increasing mass of material, and yet the greater part of that has been preserved and has come down to us very largely through accident; some family has preserved a paper, some office somewhere has preserved a letter or a document, but there is no great continuous body of material. What we have is very rich and very suggestive.

When we come down to the early American period, the American Fur Company was not an institution which was making known to the public at large very much of its opera-

tions, and yet here and there we do find a letter, a diary, some little journal, some memorandum or something of that kind, that accidentally through the various fortunes that befall historical manuscripts, familiar to historical investigators, has come down to us. I fancy that within the next fifteen or twenty years we shall discover a vast mass of new material for the reason that the various historical publishing agencies of this country, the State historical societies,
1239 the American Historical Association, the American Antiquarian Society, and other bodies of that kind, have now reached that condition in their work that they have larger funds to devote to the gathering and editing and publishing of such material than they ever had before, and the historical work is very much better organized, especially within the last five or ten years, than it ever has been before. So that to make the story short when one considers the various vicissitudes that happen to historical papers, the peculiar conditions under which some of these letters and journals were written in the past, I am often very much astonished that as much remains to us as has come down to us; little glimpses now and then, but to the historical student sufficiently illuminating to give us, I think, a pretty good knowledge of what has happened, putting two and two together, reading between the lines, applying to the interpretation of manuscripts one's general historical insight and knowledge,—a pretty good knowledge or picture of the past as it has happened in this western country during the periods of the French, British and American regimes. And yet, as I said, within the next ten years I believe there will be a great body of fresh information that will put the flesh and blood upon the skeleton of western history that has thus far been erected.

Re-cross Examination by Mr. Scott.

1240 Referring to the Thevenot map, there has been a controversy in reference to the Thevenot map. I was simply wanting to look at my memorandum to see what the controversy was. I do not remember that Parkman said the whole map was so crude and careless and based upon information so inexact that it was of little interest. At page 452 of Parkman's La Salle, a Discovery of the Great West, it is stated that Parkman condemned the map. He said what has been quoted above. The article in which that appears
1241 is by Miss Kellogg, who is my chief research assistant. I consider her the chief authority on Marquette's map.

She holds that the Marquette map was genuine and was made after the exploration. I believe that the conclusion she arrives at is that Thevenot's map was genuine and made after the exploration.

Q. Others have held that it was made preliminary to the journey from the best information that they could obtain in view of Marquette's statement as follows, "and because we are going to seek unknown countries we took every precaution in our power, so that if our undertaking were hazardous, it should not be foolhardy. To that end we obtained all the information that we could from the savages who had frequented those regions; and we even traced out from their reports a map of the whole of that new country; on it we indicated the rivers which we were to navigate, the names of the peoples and of the places through which we were to pass, the course of the great river, and the direction we were to follow when we reached it"?

A. If I remember correctly—

Q. Please answer the single question I asked you.

A. Yes, but I cannot do it without explaining. If I remember correctly Miss Kellogg's contention was that that map which Marquette made previous to his journey is the one which appears at page 188.

1242 Mr. SCOTT. I move to strike out the answer as not being at all responsive to the question. I had already brought out that Miss Kellogg indicated that this map was made after the expedition.

Dr. THWAITES. I now examine Miss Kellogg's report. I am trying to find out in this article where somebody has said that was the map which was produced previous to the journey. As to whether, if I am not able to find out in Miss Kellogg's report I am not able to answer the question, I do not pose as an authority as to the relative authenticity of

1243 the various Marquette maps. Referring to the "Chemin du retour," it purports to be the trail taken by Marquette. As to whether, as a matter of fact, it is impossible that the 'Chemin du retour" could have been taken by Marquette on his return, I would say the portion lying west of what it seems to represent as the Illinois river I do not think represents the tour. It could not. As to whether, as a matter of fact, it is one of the reasons advanced against the authenticity of the map, that Marquette could not have taken that trail, but expressly states that he came up the Illinois river, describing how far south he went, when he turned to

come back, and when he left the Mississippi, will say that has been advanced as an argument against its authenticity. It is a fact that he did return by the Illinois and did not return by that trail. I say that it purports to be the trail by which he returned because it says so on the map; that is, it purports to be on the map.

1244 Q. No, it does not purport to be on the map; what you said was it purported to be the trail by which he returned. Who gave it that import or purport, the maker of the map?

A. I have already stated that I do not pose as an authority on the authenticity of the respective Marquette maps. Those varous trails shown on that map I should say have no relation to the journey of Marquette. That is to say, they are very rude representations.

As to whether these various trails shown on this map had any relation to the journey of Marquette, I would say this portion I do consider possible—the portion on the lake. Miss Kellog says:

> "There are, however, reasons for differing from this opinion. Parkman's condemnation of the map would seem to be based upon two lines indicating trails—one following the general course of the Fox-Wisconsin route, and designated 'chemin de l'alle' (outward route); the other, striking across country to Lake Michigan from a point
> 1245on the Mississippi between Rock and Des Moines rivers, and labelled 'chemin de retour' (return route). Parkman assumed that these trails were intended to indicate the outward and return routes of Joliet and Marquette. If so, they are manifestly incorrect; but there is nothing on the chart itself to indicate that such was the intention. Rather are they meant to locate two great Indian trails which from time immemorial have followed these very routes. The outward trail follows the much-used Fox-Wisconsin water course, necessarily crossing it several times; but by no stretch of the imagination could this be intended to indicate the court of travellers by water."

If Marquette, on his return to Lake Michigan from his first journey, came up the valley of the Desplaines and saw it,
1246 he probably would have mapped it, even if he had not traversed it. Referring to LaSource, I would say I do not remember any historians who discredit the statements of LaSource as to where he went and what he did.

1247 As to whether the statement of LaSource that he made a portage of thirty leaques by land is what is called an unconscious source, I would say it seems to me that I have heard of such a term as unconscious source, but for the life of me I could not state exactly what would be meant by it. It might have a general meaning among historians and I not know it. I would not discredit Prof. Alvord or Prof. Mc. Laughlin because they classified sources as conscious and unconscious. If a statement is made by a man when there is no apparent reason why he should misstate the fact of an event occurring under his observation, I think it would be labeled by some historians as unconscious source material. I do not know of any reason why LaSource should say he made a portage of thirty leagues to Chicago unless he made such a portage.

1248 What I mean is that somewhere stored away in his noddle was the impression that at some time upon his journey he did make a portage of thirty leagues, or a journey of thirty leagues by land. As to whether there is any reason why he should have stated that he had made it if as a matter of fact he did not make it, I know of no reason why he should make such a statement. I take it that LaSource was a member of St. Cosme's party throughout.

Q. The journey up was made at about this season of the year, was it not, and you do not depend upon LaSource to establish that fact?

A. I am looking to see if the two hitch together before I answer. St. Cosme as I read him rather hurriedly here, does not say anything more about this after he got down

1249 among the Arkansas. The only evidence that I have thus far been able to discover is that La Source says that they made the journey at that time. That is all that evidence that happened to strike my eye. Referring to the Board of Trade Report and the reference to a fort at the mouth of the Chicago river, the references that were made were from French manuscripts entitled "The Cadillac Papers." They were from Margry, from the Cadillac Memoirs, all French. I do not think that any of them were translated into English and given to the public prior to 1721, when the Board of Trade Re-

1250 port was written. I am not aware that the author of the Board of Trade Report had access to these French manuscripts. As a matter of fact, I do not think the scholars had dug them up by that time, nor for many years afterwards.

Referring to Hubbard, I have not found any evidence to indicate that he did not continue the post at Hennepin. As

to whether the indications are that he still had posts on the Illinois river after he continued the trail from Danville to Chicago, I would say that, as I read Hubbard, it seems after
the year 1824, in 1825, on page 138, he seems to have had
1251 some business toward St. Louis and arranged with a
man at Peoria to take a boat. While Mr. Hubbard does not definitely state, on page 143 when he gave up his connection with the American Fur Company, I judge that it was about this year 1825. As to whether I think he went out of the business then, I will say, no, because he refers to his headquarters being at Iriquois Post. Then we do not hear very much more about him until page 147, when at the bottom of the page he says: "I had already located at Danville, where I intended in future to make my general headquarters."

Then while he is there he makes application for the position of Indian trader at Chicago. Then business is so poor during 1827 and in 1828 that he built a store at Danville and permanently establishes headquarters there. Then in 1828 you will remember that he met Cass and beyond that I do not see that he did very much business. As to whether he terminated his relations with the fur company in 1824, I would say he may
have done so. It is difficult to say. There is more evi-
1252 dence that he continued in business. On page 148 he says
that in 1827 he purchased the entire business of the American Fur Company in Illinois. I overlooked that. On page 138 I find him in 1825 renting a boat at Peoria to go to St. Louis for supplies for Mr. Kinzie. I have alluded to that. On page 138, he says he started the Hubbard trail, though not to Chicago, in 1822, from Iroquois Post to Danville.

Q. You gathered that there was a cessation of a good share of his business in Illinois, because in the winter of 1825 he was at his Iroquois post. As a matter of fact he has established a home at the Iroquois post two years before when he was still engaged in making these trips for the fur company which you have referred to as having been made up and down the Desplaines river, isn't that true?

A. I find on page 131 it stated as you say. Contem-
1253 poraneously with the business carried on at Iroquois,
from the country south there, he had been carrying on business on the Illinois river at Hennepin. I do not see any reason to believe that in continuing the business below he had abandoned the business at Hennepin. As to whether I am aware that the narrative of Hubbard was not made up from his diary but made from statements made at the time he was

about eighty years old through some connection, I would say, his nephew on the title page says: "Collected from personal narrations and other sources." There may have been several narrations. He says a little further on in what stands for the preface: "The following pages are partly autobiographical, and partly compiled from the narrations of Mr. Hubbard, and from letters and other documents written during the years of which they treat."

It says that the diary which he kept was loaned to Col. McRoberts and could not be recovered.

Q. Does not the fact that Hubbard states at page 43 that it took three weeks to go from Isle a la Cache to Ottawa, a distance of sixty miles, with his boat, indicate a reason why he abandoned the Desplaines river?

Objected to as not proper cross-examination.

A. The instance which you mentioned on page 43 may well have been one of the difficulties which he said existed upon this route.

Q. I have one more question; you have testified that the passageway in the early spring was comparatively easy.

1255 As a matter of fact, he says on page 59, does he not, that the progress up, and this was a spring trip, from Starved Rock to Cache Island, was very slow?

Same objection.

A. He says on page 59 that their progress was very slow from Starved Rock to Cache Island. As to whether that trip was made in the spring will say that journey appears to have been made in March, and the river at that time he says on page 60 was high.

1256 WILLIAM KRAMER, called as a witness on behalf of the Government, testified as follows:

I reside at 1117 Pratt avenue, Rogers Park. My business is civil Engineer and surveyor, at Room 914, Stock Exchange Building, Chicago. From 1878 to 1881 I was engaged in surveying; 1882 to 1884 with the Mexican Central Railroad in the engineering office. The work consisted mostly of draft-

1257 ing. In 1885 I had a contract for the Mexican Government to arrange public lands. From 1886 to 1891 I was with the United States Geological Survey, in the field as topographer. In 1891, I was in charge of the field parties of the Lake Superior Survey which was directed by Professor Van

Hise of Madison, Wisconsin. From 1892 to 1900 I was with the Sanitary District in the main engineering office. The work was drafting and designing, at times I went out surveying. From 1900 up to now I have been engaged in business as civil engineer, and surveyor, particularly hydraulic engineering.

While working for the Sanitary District, I made topographical maps of the Sanitary District.

COUNSEL FOR GOVERNMENT. I will say that we intend to introduce a copy of the Sanitary District map, but we haven't it here this morning and we will just pass that for the time being.

The WITNESS. I would like to add that during that
1258 period from 1878 to 1881 I went to a school of technology during those years. This map which is handed me is an exact copy of McCullough Exhibits 1 and 2 which were used in the trial of the case of the People against the Economy Light & Power Company. There has not been anything added or anything left out of this map; it is an exact copy. McCullough Exhibit 1 and McCullough Exhibit 2 were in two separate sheets; I traced them together, so as to make one continuous sheet for the purpose of being easier to handle. There are no alterations or omissions on this map.

COUNSEL FOR GOVERNMENT. We intend, Mr. Scott, to offer this in evidence. If you have any objections to it, I would like
1259 to have you cross-examine at this point. If you wish to verify it or check it up, I will be only too glad to permit you to do so.

COUNSEL FOR DEFENDANT. I object to it now as incompetent, irrelevant and immaterial; but I reserve the right if upon comparison with the documents we have we find any other objections, we reserve the right to object to it on those further grounds.

COUNSEL FOR GOVERNMENT. I will offer this map in evidence and ask to have it marked "Kramer Exhibit 1."

(Said map so offered in evidence was marked "Kramer Exhibit 1.")

(Said Kramer Exhibit 1 appears in Appendix, p. ——.)

Q. You may state as to what this Kramer Exhibit 1 portrays—

Objected to on the ground that the map speaks for itself.

The WITNESS. It portrays the Desplaines river from its mouth to the township line between townships 38 and 39; it also shows the swamp east of the turn of the Desplaines river in section 12, township 38, 12, east of this point. Also a water

course running from out of this swamp to a point in section 25; 39; 13; and from the same point there is a water course leading toward the Chicago river which is commonly called the West Fork of the South Branch of the Chicago river.

It also shows the Chicago river, the south branch of
1260 the Chicago river to Lake Michigan. The document which is handed me is a certified copy of certain pages of the original field notes of the United States survey of lands in section 1, township 38, north range 12 east of the third principal meridian, contained in Vol. 247, page 157-158 of record of said field notes of the United States survey. I made use of them while I was with the Sanitary District on a number of occasions.

Q. How are they regarded among surveyors?

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. Why these are the official notes of the meander of the Desplaines river and they are commonly taken as the best—as the original survey of the Desplaines river.

Q. I will ask you how those notes are regarded by surveyors.

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. When the surveyors run a meander along
1261 the stream they note all the different objects they come across; as you see here in these notes, they give the bearings and the distances and the connections, and the section lines, the distances from section corners, don't you see.

Q. How are those notes regarded among surveyors?

Objected to.

The WITNESS. They are regarded as being a part of the work which is necessary to make a complete meander.

Motion by counsel for defendant to strike out the answer as not responsive to the question.

The WITNESS. In other words it shows the condition of the Desplaines valley at the time when the meander was made.

Motion by counsel for defendant to strike out the answer as not responsive to the question and as a conclusion of the witness that is not competent.

COUNSEL FOR GOVERNMENT. I will call your attention on page 158 to a note which indicates how the line was run and ask you to read the last entry on page 157 and the first entry on page 158, including the note.

The WITNESS. "North 66½ west, 2.37 chains to the cor-
1262 ner of fractional section 1 on the town line between towns 38 and 39, range 12 east." "Meanders down the north

side of Laplain through section 1, township 38, north range 12 east from the head of navigation."

Q. Will you please explain the interpretation that you would put as a surveyor upon the entry which you have just read?

Objected to as incompetent, immaterial and irrelevant, and as the conclusion of the witness, that the memoranda appearing in the field notes which have just been read is not in itself competent evidence and is no part of the duty of the original surveyor who made the field notes.

1263 The WITNESS. It means that the surveyor ran in a northeasterly direction along the south or east side of the Desplaines river until he came to the township line, between towns 38 and 39, which point he marked "Head of Navigation." He then crossed the river and meandered down stream along the north or west side of the stream.

On the map now shown me, which has been marked "Kramer Exhibit 1," the point I say he changed from meandering up the south or east bank of the Desplaines river and turned and meandered down the north or west bank, is a point 30.84 chains west of the northeast corner of township 38, north range 12 east, and is marked here by a cross which cross appeared also on the original sheet which I copied, the cross

1264 is right at the township line between townships 38 and 39, where the Desplaines river crosses the township line.

I made my copy from the exhibit of the state—the orig-

1265 inal map was made probably in 1821. I made a copy of a copy of that map as the certificate shown here. I did not make a copy of the original map at Springfield. I don't know whether the star referred to is on the original map at Springfield or not.

COUNSEL FOR DEFENDENT. I object to the introduction of this copy of a copy.

COUNSEL FOR GOVERNMENT. I will state for the record

1266 that the copy which Mr. Kramer used was the original certified copy by Mr. McCullough which was filed in the state case.

COUNSEL FOR DEFENDENT. It bore marks which were not on the original which we objected to at the trial.

COUNSEL FOR GOVERNMENT. In order that no question may be raised as to the location of this point, I will ask the witness to put a mark "A" there at the point which he refers to; and I will ask the reporter to put his initials there, so that there may be no question as to the point.

(The witness marked the point referred to in pencil "A"; the reporter marked his initials in ink "N. S.")

The WITNESS. The point which is shown on page 157 of these field notes, or the note which is made "across the portage creek or swamp" is at a point where the Desplaines river after following a northeasterly course turns to a northwesterly course and is in the northeast quarter of section 12, township 38, north range 12 east, about 10 chains east of
1267 the range line between ranges 12 and 13, and it is about 10 chains west of the range line, between ranges 12 and 13. I have marked that point on there with the initial "B."

Objected to.

(The witness marked the point referred to, in pencil "B."

The WITNESS. There is a memoranda at the bottom of page 158, after the surveyor has come to the corner of fractional sections 1 and 12, he makes this note, "Land high level prairie, a little timber, lower end on the bank of the river, river crooked, wide and swamp."

Objected to.

The WITNESS. The author of these field notes is shown by a note on page 157, giving the date, October 16, 1821, and the name of John Walls. There is also a note at the bottom of page 158, the date being October 17, 1821, and again the name of John Walls.

1268 COUNSEL FOR GOVERNMENT. We offer these pages 157 and 158 of the certified copy of Book 247 of the Field Notes of the United States Survey in evidence. Let the record show that it is hereby stipulated that this copy of the Field Notes may be withdrawn and a copy substituted therefor after Mr. Scott has had an opportunity to correct and check it up.

Which said pages are in the words and figures following:

1268a (Volume 247, Page 157)

N	32½	E	3.50	
N	18	E	4.47	across the Portage
N	33½	W	5.71	Creek or swamp
N	38	W	3.50	Oct 16th 1821
S	52	W	4.00	Jno. Walls
N	36	W	2.50	
N	1½	E	5.30	
N	5½	W	1.83	to the Cor of F Sects 1 & 12
			30.81	

Land level prairie some scattering timr on the River Soil good Continued through Sect. 1

N	7	E	1.75	
N	20	W	3.84	
N	26	W	2.90	
N	41	W	4.50	
N	6½	E	2.00	
N	84	W	3.28	across a swamp
N	54	W	2.25	
N	8	E	2.50	
N	6	E	16.00	
N	4	W	17.00	Land high & dry soil
N	18	E	5.00	good 2nd rate timr
N	43	E	6.50	B & W oak
N	5	E	7.50	
N	28½	W	10.00	
N	41½	W	4.00	
N	66½	W	2.37	to the Cor of F Sect 1 on

91.39

Town line between Towns 38 & 39 R 12 E

1268b (P. 158)

Meanders down the N side of Laplain through Sect No 1 T 38 N R 12 E from the head of navigation

S	34	E	4.06	
S	48	E	6.00	
S	24	E	2.65	
S	43	E	6.93	
S	15½	W	5.00	
S	30½	W	7.50	
S	3½	W	13.00	
S	13	E	3.50	
S	5½	W	13.00	
S	7	W	7.00	
S	16	W	8.76	Oct 17th 1821
S	41½	W	4.21	Jno. Walls
S	6	E	7.23	to the Cor of F Sects 1 & 12

88.84

Land high level prairie a little timber lower end on the bank of the River River Crooked wide & swampy

1268c STATE OF ILLINOIS, AUDITOR'S OFFICE.

Springfield, February 11th, 1908.

I, James S. McCullough, Auditor of Public Accounts of the State of Illinois, and lawful keeper of the seal of said office, and by law custodian of the field notes of the United States Surveys of lands in Illinois pursuant to the requirements of Section 10 of an act of the General Assembly of Illinois, approved March 2, 1874, entitled "An Act to revise the law in relation to county surveys and the custody of the United States field notes," do hereby certify the foregoing document is a true and correct copy of the original field notes of said United States survey of lands in Section One (1), Township Thirty-eight (38) North, Range Twelve (12) East of the Third Principal Meridian, contained in Volume 247, Pages 157 and 158, of record of said field notes of United States Survey, on file in this office.

In Testimony Whereof, I hereunto subscribe by name and affix the seal of my office, the day and year first above written.

(Signed) J. S. McCULLOUGH
Auditor of Public Accounts.

(Auditors)
(Office)
(Illinois)

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. As before stated, the surveyor, Mr. John Walls, by these Field Notes shows that he meandered up and down the east bank of the Desplaines river to the township line between townships 38 and 39 and then proceeded down stream along the west side of the river. But the Desplaines river was not meandered northward from that line between townships 38 and 39 in range 12. I have had occasion in connection with my duties with the Sanitary District to
1269 consult the field notes of the United States surveyors in reference to the topography of the Desplaines river basin and surrounding territory.

Objected to as incompetent, irrelevant and immaterial and as assuming that the field notes in question were made a part of the United States surveys.

The WITNESS. I have had occasion to use these notes a number of times when I found that Mr. Walls was evidently United States deputy surveyor and under the direction of the surveyor general made surveys of the part of the territory

which is between the two Indian boundary lines. His work started at the range line between ranges 10 and 11 where the Desplaines river crosses the same; he ran up fol-
1270 lowing the course of the Desplaines river with his meander line up to the point which I have previously marked "A" on this map. He also surveyed across from point "B" marked on this map, across the swamp adjacent to the Desplaines river and running in an easterly direction over to the Chicago river, the mouth of the Chicago river.

Objected to as not responsive to the question.

The WITNESS. These notes by Walls are commonly taken by the surveyors as being the best records of the sectional survey of the meander of the Desplaines river. In fact there is no other data from which to establish or re-establish section lines or meander lines.

The map which is now shown me is a copy of Orr Exhibits 3, 4 and 6, a part of Orr Exhibit 2 on a reduced scale.
1271 The original sheets were on a scale of 1 inch equals 4 chains; Orr Exhibits 3, 4 and 6 were on this scale. Orr Exhibit 2 was on a scale of 1 inch to a mile. These sheets were reduced by me or enlarged, and put together so as to show one continuous map. The scale of the map is 2 inches equals 1 mile.

The Orr Exhibits 2, 3, 4 and 6 are the Orr Exhibits in the case of the *People of the State of Illinois ex rel.* v. *The Economy Light & Power Company?* This map was drawn by myself from the original exhibits in the State case, to-wit: Orr Exhibits 2, 3, 4 and 6, except that it is on a reduced and enlarged scale; that is, a reduced scale as to exhibits 3, 4 and 6, and an enlarged scale as to exhibit 2? Otherwise there
1272 are no alterations from the exhibits as they appeared in the State case. The engineer or surveyor who made the originals from which this map has been reduced or enlarged was Mr. H. A. Mathewson.

Objected to.

The WITNESS. Orr Exhibits 2, 3, 4 and 6 are blueprints from a tracing which I made at Lockport in 1892 and I can always tell Mr. Mathewson's handwriting on maps, and on some of the maps he has made notes in which he signs his name "H. A. Mathewson." For that reason I know the map has been prepared by H. A. Mathewson for the Illinois and Michigan Canal Commission.

Q. State what the map shows?

Objected to; the map speaks for itself.

The map shows the Desplaines river in section 12, township 38 north, range 12 east. It also shows a body of water
running from the Desplaines river in an easterly or
1273 northeasterly direction through sections 3, 4, 5, 6, 7 and
8, township 38 north, range 13 east, and through sections 25, 33, 34, 35 and 36, in township 39 north, range 13 east; and through sections 29, 30 and 31, in township 39 north, range 14 east. Surrounding this body of water which is marked here Mud Lake or Portage Lake is a swamp. From the easterly end of this swamp is leading a stream or water course through sections 25 and 36, township 39 north, range 13 east; and section 36, township 39 north, range 14 east. This stream runs over to the south branch of the Chicago river to a point marked Bridgeport on the south branch of the Chicago river.

There is also shown on this map a stream of water leading out of what is called on this map the south arm of Mud Lake. This stream runs in an easterly direction, is also surrounded by a swamp; at the easterly end of the part of the swamp shown here is a note which is as follows: "This depression extends from the south arm of Mud Lake to the east fork of the south branch of the Chicago river."

This map also shows the so-called State Ditch in section 36, township 39 north, range 13 east. The town of Bridgeport, the Illinois and Michigan Canal, part of Archer Road and the town of Summit. Also the old portage trail in section 34, township 39 north, range 13 east.

The water course extending from the Desplaines
1274 river to sections 3, 4, 5, 6, 7, and 8, is called here Mud
Lake. When I took that in I meant to show the branches, I meant to include the branches of Mud Lake and the swamps surrounding the branches of Mud Lake. The main body of Mud Lake is in sections 5, 6, 7, and 8, township 38 north, range 13 east; and in sections 33, 34, and 35, in township 39 north, range 13 east.

Cross-Examination.

I knew Mr. Mathewson. The copy of Mr. Mathewson's
1275 map was made at Lockport, a copy was made by the
Sanitary District and this copy I made from that blueprint in March, 1892. Mr. Mathewson died three or four years ago. The original Mathewson map is at Lockport in the archives of the Illinois and Michigan Canal Commission.

The Mathewson map made for the purpose of showing the right of way of the Illinois and Michigan Canal and it
1276 showed the canal and the ninety-foot strip on either side and it was made about 1847.

COUNSEL FOR GOVERNMENT. We offer the map in evidence and ask to have it marked Kramer Exhibit 2. (Said map so offered in evidence and marked Kramer Exhibit 2 and appears in Appendix, p. .....)

COUNSEL FOR DEFENDANT. We object to the map as incompetent, immaterial and irrelevant.

Re-direct Examination.

The WITNESS. Mr. Mathewson was one of the oldest settlers and oldest surveyors and engineers in this part of the country. He became connected with the Illinois and Michigan Canal during its construction. His principal work there was right of way matters, right of way surveys, that is surveys which are still on record in the office of the Illinois and Michigan Canal Commission; some of the surveys and maps are also on record in the office of the Sanitary District of Chicago.

1277 After the completion of the Illinois and Michigan Canal Mr. Mathewson settled at Lockport and carried on the business of engineering and surveying during a great many years, I think up to about 1890, when he practically retired from active life. He died at Lockport. In fact he did live at Lockport for probably fifty years as much as I know. His work is regarded as being substantially correct; he was a very careful man. He did a lot of work during his life and a great deal of his work is in evidence in the court house in Will County, and also here in Cook County. His work is generally taken as an authority among surveyors. The blueprint in the possession of the Sanitary District is a copy of the right of way maps on file in the office of the Illinois and Michigan Canal trustees at Lockport, Illinois. I made at Lockport a copy of the Mathewson map an exact tracing, from the copy in the possession of the Sanitary District. It is the same tracing which I made and the blue
1278 print which was introduced in the State case, is a copy of the tracing. A blueprint of that tracing which I made at Lockport.

Objected to.

The WITNESS The map which is now handed me is a map of the Illinois and Michigan Canal, the Desplaines river from the mouth of the Desplaines river to Chicago. It was made by H. A. Mathewson of the Illinois and Michigan Canal. This is Orr Exhibit 28. This blueprint was made from the original tracing which I made in Lockport in 1892. Those tracings were introduced in the state case. This was Orr Exhibit 2. The scale of this map is one inch to one mile. This is the map which I used in making the Kramer Exhibit 2. From this Orr Exhibit 2 I used section 6, township 38 north, range 13 east; sections 25 and 33, township 39 north, range 13 east; and sections 29 and 30, township 39, range 14 east. This is
a print made from the original tracing of the original
1279 map at Lockport by H. A. Mathewson.

The Government offered these blueprints in evidence and asked to have it marked Kramer's Exhibit 3-A and 3-B.

The WITNESS. Kramer Exhibit 2 is a reproduction of the blueprints just now referred to as Kramer's Exhibits 3-A and 3-B.

From Orr Exhibit 2 I took sections 6, 25, 29, 30 and 33, the rest of this was made from the map at Lockport.

Objected to as incompetent, irrelevant and immaterial.

1280 The WITNESS. This map, Kramer Exhibits 3-A and 3-B, shows the river from Dresden, the township line of Dresden, which is at the mouth of the Kankakee and the Desplaines rivers, to the township line at Riverside between townships 38 and 39. It also shows the villages which existed at that time or which were planned by the Illinois and Michigan Canal Commissioners. It also shows Portage Slough or Swamp extending from the Desplaines river to the Chicago river. It shows a continuous swamp or stream from the Desplaines river to the south branch of the Chicago river. It also shows the depression which was marked on Kramer Exhibit 2, the depression which leads to the south fork of the Chicago river. It is the south fork of the south fork or the south arm of the south fork of the Chicago river. It was formerly called the east fork. Mr. Mathewson called it
the east fork but it is known as the south fork of the
1281 south fork today. This map also shows the Calumet feeder and part of the Calumet river, Calumet Lake, the Sauganash Swamp and Stony Pit; the towns also, and the town of Portland which today is known as Blue Island. It also shows the Illinois and Michigan Canal from the mouth of the Desplaines river to Bridgeport throughout its length.

The Calumet feeder is a feeder to the Illinois and Michigan Canal. It also shows the Kankakee feeder; the Kankakee feeder is about three and a half miles long. It starts at a dam about five miles from the mouth of the Kankakee river and runs parallel with the Kankakee river, crossing the Desplaines river on an aqueduct, and immediately after passing the aqueduct it enters into the old Illinois and Michigan Canal. It also shows the point where the Illinois and Michigan Canal enters into the Desplaines river at Joliet. This point was usually called the upper basin. Here is where the waters of the Desplaines and Illinois mingle with those—that is the waters of the Desplaines river and the Illinois and Michigan Canal mingle, and for this reason the Des-
1282 plaines river might also be termed a feeder of the Illinois and Michigan Canal. The same condition practically exists at Channahon, and points named here on this map, DuPage, so that even the DuPage river might be considered a feeder to the Illinois and Michigan Canal.

The Government offered these maps, which have already been marked Kramer Exhibits 3-A and 3-B.

(Which said maps so offered in evidence were marked respectively Kramer Exhibit 3-A and Kramer Exhibit 3-B, and appear in Appendix, p. .....)

The WITNESS. The map which is handed me is a map of Chicago and the continental divide in 1847. I compiled this map, from the United States Government Land Survey of 1821, or McCullough's Exhibits No. 1 and No. 2; Illinois and Michigan Canal Survey, Mathewson No. 7; Orr Exhibits
1283 4, 3, 6 and 2; Mathewson's Survey of the Chicago River, 1847, in possession of the Sanitary District of Chicago; the official plat of Bridgeport as laid out by the Illinois and Michigan Canal trustees; topographical map of the Sanitary District of Chicago; the scale of this map is two inches equal one mile.

Q. Explain what this map shows?

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. This map portrays the Desplanies river in township 38 north, range 12 east, to the head of navigation. It also shows a stream or body of water called Portage Lake leading out from the Desplaines river in an easterly or northeasterly direction. At the east end of the lake the stream is shown to a point near the range line, between ranges 13 and 14, in section 25. This stream leads from the divide into

Portage Lake. And there is another stream shown leading from the divide into the Chicago river. The map also shows the old portage road, the Archer Road, the town of Summit, the Illinois and Michigan Canal from Willow Springs to Bridgeport; the Chicago river, and that part of Chicago which existed in 1847 at the time Mr. Mathewson made a sur-
1284 vey of Chicago. It also shows the point where Marquette wintered during the winter from 1674 to 1675; and also shows the head of navigation as shown in the field notes of John Walls on October 16, 1821.

It furthermore shows the depression leading from Mud Lake in almost due easterly direction toward the south fork of the south fork of the Chicago river. Also the state ditch in section 36, 39, 14.

Cross-Examination by Mr. Scott.

The WITNESS. The site of Marquette's cabin was taken from an official document which I can give you; it is in the report of the Internal Improvement Commission of Illinois, 1907, on page 3. I accepted that as authority, it being a public document. As a rule, anything cited in a public
1285 document I accept as authority. That report was made by the Internal Improvement Commission. I think Mr. Randolph was on that commission, and Mr. Cooley, and one more. I am not familiar with the personnel of that commission at all. They were acting under the authority of the legislature, I presume. I never heard that the site of Marquette's cabin is placed by authority at Summit. I always thought that Marquette's cabin was at Robey street on the west fork of the south branch of the Chicago river. I understand that the cairn erected at Summit is to show the
1286 point where Marquette landed. I do not know anything about that monument at Summit. I am only familiar with the point marked there, and have taken that because some commission stated that that was where Marquette landed. This map indicates my conclusions from certain other maps and surveys and compilation of surveys. The site of Marquette's cabin is the only place which I do not find in any other map.

Q. There is no map upon which is written what I have written "Head of navigation according to John Walls' government surveyor, October 16, 1821." Mind you I exclude

the field notes in that question; there is no map which
1287 has that written on it, is there?

The WITNESS. I cannot think of any just now. I have not come across any information as to whether this portage road so called extends beyond the Desplaines and down southwesterly on the other side of the Desplaines river and I did not make any effort to ascertain whether that was so. There is a road crossing the river just west of Summit, the road extends—it shows the fork of the road there. I could not give you any information as to where the road goes because

I have simply copied this from Mathewson's map here
1288 and he shows it that way. While this purports to show Chicago and the continental divide and shows portions of certain roads it does purport to be an accurate representation of those roads within the district covered by the map east of the Desplaines river.

Object to this map as being the conclusion of the witness upon certain data, as incompetent, immaterial and irrelevant; that no proper foundation has been laid,
1289 and as being the mere conclusion of the witness; that it does not adequately, upon his own testimony, represent that which it purports to represent, and that it contains matter on his own testimony for which no basis exists.

The WITNESS. I made new map in June, 1910, for the purpose of—I had orders to make this map; from the attorney representing the United States government. I presume it was made for this suit.

(Which said map so offered and identified was received in evidence and marked Kramer Exhibit 4.)

Re-direct Examination.

Q. Referring to the dot and the words "Site of Marquette's Cabin, 1674-1675," there is no other lines, marks or other data on this map which is not included in the material which I have stated was used in the compilation of this map?

A. No other.

In reproducing Mathewson's survey, I followed him exactly as to the length of road and the termination of it. The portage road in section 30, township 39 north, range 14, was taken from McCullough's Exhibits 1 and 2.

Objected to because both maps are in evidence.

The WITNESS. I have shown the termination of the
1290 portage road in section 1, township 38 north, range 12, as terminating where shown on that exhibit and in the same way. The point marked "Head of Navigation" according to John Walls, Government Surveyor, October 18, 1821, was taken from the field notes already in evidence here; locating the point as directed by the lines run by the surveyor.

COUNSEL FOR GOVERNMENT. The government offered this may in evidence and asked to have it marked "Kramer Exhibit 4."

(Kramer Exhibit 4 appears in Appendix, p. .....)

Objected to.

The WITNESS. At a point in section 25, township 39 north, range 13 east, there is a water course beginning at the eastern part of that section and running in an easterly direction and emptying into the west fork of the south branch of the Chicago river. Also a water course about 1/8 of an inch from the beginning of the other water course, in section 25, just mentioned, and proceeding in a southwesterly direction and emptying into the swamp surrounding Portage Lake. These
1291 were taken from McCullough's Exhibit 2. The one-eighth of an inch space shown between the two water courses show the divide. In this particular case it would show the Continental divide of Chicago. The Continental divide is a place where the waters flow in different directions, in opposite directions, and to different seas.

East of the point just mentioned the water flows into the Chicago river and the great lakes, to the Gulf of St. Lawrence. West of it it flows into Portage Lake, thence into the Desplaines-Mississippi river, and the Gulf of Mexico.

The Mathewson survey shows a continuous line, a continuous waterway from the east end of Portage Lake to the Chicago river; it does not take note of the Continental divide at all.

1293 The title of the map now shown me is as follows: "Sanitary District of Chicago Map and Profiles of the Sanitary and Ship Canal of Chicago, from Chicago to Joliet." The scale of the map is 2 inches one mile; contour interval 5 feet. The profile scales are horiozntal one inch equals 2,800 feet. This is a map which was prepared in 1892 by myself, when connected with the Sanitary District; from field notes I constructed the map with the exception of the lettering. It

shows the routing of the Sanitary and Ship Canal of
1294 Chicago and this map shows the route of the drainage canal. It has been and is now an official map of the Sanitary District. I delineated the section lines, roads, subdivisions, and so on, and I also delineated the topography. This is a topographic map showing contours every five feet. It takes in about three miles on each side of the Sanitary Canal. It shows the physical features of the Desplaines Valley from Chicago to Lake Joliet, and two or three miles on each side of it. It shows the course of the main drainage channel and also the river diversion of the Desplaines river. It shows the Illinois and Michigan Canal; it shows that it is a complete map.

1295 *Cross-Examination.*

The WITNESS. The field notes from which this map was made were taken by Mr. Alexander, who took the field notes of that; and also along the bottom of the valley and the regular field notes of the sanitary district. I think this blue print was made by Mr. Pearson.

COUNSEL FOR GOVERNMENT. The government offer this map in evidence and ask to have it marked "Kramer Exhibit 5."

Objected to as incompetent, irrelevant and immaterial.

(Which said map so offered in evidence was marked "Kramer Exhibit 5," and appears in Appendix, p. .....)

The WITNESS. The line of the main channel of the Sanitary District of Chicago is shown on the map now handed me as a red band extending from the west fork of the south branch of the Chicago river at Robey street to Joliet. The river diversion has not been colored on the map, but it is
shown by these heavy blue lines, and it is labelled in
1296 several places, "River Diversion" and it is marked; also the Sanitary Canal. The light lines, the lines beneath that, is shown, the old channel of the Desplaines river prior to the diversion. The controlling works of the Sanitary District are just west of Lockport near Section—that is on the line between sections 15 and 22; in fact I might say that it is in the corner of sections 14, 15, 22 and 23, in Lockport Township 35, 10. The power station and the lock and canal by which navigation is extended down to Dam No. 1 at Joliet is shown on that map. It is not marked but it is on the line between sections 27 and 34. It is indicated by a tri-

angle shown here. It begins where that triangle is shown and extends down to the heavy blue line in Joliet. That is
the extension of the Sanitary Canal. There is a lock
1297 at that point where ships can lock down from the drainage canal into the Illinois and Michigan Canal; it has just been opened recently. There is a profile on that map and it shows the original contour of the ground before the canal was dug. It also shows the grade and the depth of the canal and the river diversion. This red line representing the channel of the Sanitary District of Chicago is shown as connecting with the upper basin at Joliet. The connection between the Sanitary District Channel and the upper basin was completed about a year ago. This extension of the Sanitary District from the power house to the upper basin at Joliet was started about six years ago, and was completed about a year ago, so it took about four or five years to build
those works there, including the power plant. The
1298 ship canal was extended. The ship canal originally only went as far as Lockport to the controlling works which I have just pointed out. Afterwards this canal was extended for a distance of about two miles to the new power station, and while the power station was being built, the lock was put in which made it possible for ships to lock down from the drainage Canal into the old Illinois and Michigan Canal. A tail race was constructed which entered the Illinois and Michigan Canal from Robey street to Ruby street in Joliet, to Dam No. 1, thus making a continuous waterway. By means of this lock at Lockport it was possible to take a boat into the Sanitary District Channel and thence into the basin at Joliet, up to Dam No. 1. There are no other obstructions in the Sanitary District Channel. The reasons for building that lock were to facilitate the traffic from the Sanitary and ship canal to the old Illinois and Michigan Canal. The idea is that a part of the
Illinois and Michigan Canal would be abandoned from
1299 Joliet to Chicago. The map now shown me is an exact copy of McCullough Exhibits 1a and 2a, in the case of the People versus the Economy Light & Power Company.

By agreement between counsel, whatever occurred in
1300 the record when Mr. Edgar Williams was testifying on Exhibits 1a and 2a in the state case, will go in and the map will go in subject to such objections as were made.

The WITNESS. Referring to the point in Section 30, Township 39, Range 14, marked "Approximate location of Mar-

quette's cabin 1674 and 1675," I will state that it was on the original McCullough Exhibit 2a.

Q. Do you know anything about as to whether or not the Sanitary District has located Marquette's cabin at that point?

Objected to as incompetent, immaterial and irrelevant, hearsay, and that the conclusion of the Sanitary District if it had arrived at any such conclusion would be incompetent and immaterial.

1301 The WITNESS. There has been a monument erected there according to what I have read in the papers a few years ago at the point where the cabin was supposed to have stood. It is at the foot of Roby street but I have never seen it.

COUNSEL FOR GOVERNMENT. We ask to have that map marked "Kramer's Exhibit 6."

Kramer's Exhibit 6 was then marked and offered in evidence and appears in Appendix, p. .....

The WITNESS. The map now shown me is a topographic map; the title is as follows:

"Sanitary District of Chicago, map Lake Michigan to Willow Springs. All of the topography west of Western avenue from surveys, by the Sanitary District of Chicago, June 1, 1892." Scale, one inch equals eight hundred feet. All elevations not otherwise marked are above Chicago city

1302 datum. It shows the topography of a strip of land, adjacent to the route of the drainage canal from Bridgeport to Willow Springs in one foot contour lines. It does not show the Sanitary District Channel. It shows the Illinois and Michigan Canal. This map was made before the Sanitary District Canal had been planned. The surveys were made from 1889, to 1892; about 1892, the beginning of 1892. The original of this map I prepared, for the Sanitary District at that time, except the lettering, or except some of the lettering, I will say. This map has been given me by

1303 the District Attorney and I was asked to color it up to bring out elevations. This map has been colored up to certain elevations. For instance, take the pink color; everything which is colored pink on this map is below an elevation of plus 8 Chicago city datum. Everything colored green on this map refers to elevation between 8 and 9.6 Chicago city datum. Everything colored neutral on this map, the neutral tint is kind of a gray tint here, grayish red, you might call it; everything colored by that is between elevations 9.6 and 10.5. The sienna tint covers the elevation of 10.5 to 11.73.

I have also added on this map the portage road. It starts at the line between sections 1 and 12, Township 38 North, Range 12 East, running in a northeasterly direction to the township line, or, rather range line between ranges 13 and 14 East, which is today known under the name of Western avenue, within the city limits of Chicago. I also added on this map the state ditch in Section 36, Township 38
1304 North, Range 13 East. Nothing has been added to this map, or done, except to color up the elevations I have now specified, and adding the portage road and the state ditch. Of course, the explanation to these colors has been added; this memorandum as to the explanation of these colors.

The government offered this map in evidence and asked to have it marked "Kramer's Exhibit 6A."

Objected to, as incompetent, immaterial, and irrelevant.

(Which said map so offered in evidence was marked "Kramer Exhibit 6A," and appears in Appendix, p. .....)

Q. You may point out on this map the location of the portage road in reference to the contour lines, that is how high was the portage road as compared with Mud Lake, if you can find it?

Objected to.

The WITNESS. The portage road seems to run along an elevation of about 14 or 15 Chicago datum; in some places 12. Say from 12 to 16; while the water surface and the portage swamp at low water was probably 8 Chicago datum. I want to explain that this portage road was taken from
1305 Exhibits 1 and 2 McCullough, which have been introduced, I think as Kramer Exhibit 1. That starts out at Western avenue at an elevation of about 11; it then would have run directly through the Bridewell, coming up to an elevation of 12; crossing Kedzie avenue at about the same elevation between 11 and 12, and running southwesterly; at Central Park avenue the elevation would have been about 11; at Crawford avenue, the elevation would have been about 12. Crawford avenue is one mile west of Kedzie. At the Belt Line Railroad, it would probably reach in the region of 15.5; running through the old race track at Hawthorne at an elevation of 15; crossing Central avenue, on 39th street at an elevation of 14 to 16; thence running still in a southwesterly direction along the slope of the hill at an elevation of 14, about, and 15.

In Section 6, Township 38 North, Range 13 East, it
1306 commences to run down to an elevation of about 11.5. It again runs up to an elevation of 14.5, in the southwestern part of Section 6, mentioned before. At the township line between ranges 12 and 13, it runs down to an elevation of 12, and at the end here it is between the elevations 13 and 14, which makes the end of the old portage road at about 13.5. The end of that portage road is within a few hundred feet of the Desplaines river; no portion of the portage road goes through Mud Lake. The portage road is pretty well out of high water mark in reference to the high water of Mud Lake and the Desplaines river. It is above the high water mark.

The continental divide as shown by contours on this map—would be a little east of Kedzie avenue. I would say between Kedzie avenue and California avenue in the vicinity of
1307 what is known today as the bridewell. The contours 11 seem to close up here at this point (indicating a point on the map), so I take it that the original ground must have been 10.5, between 10 and 11, above Chicago city datum. The flood waters of the Mud Lake region could escape if they raised high enough towards Lake Michigan, and did undoubtedly escape through another opening here at Kedzie avenue about the east quarter corner of Section 35, 38, 13. They passed through a depression extending from the south fork of the Chicago river. That depression is shown by a neutral color on this map. The Continental Divide between the Desplaines river and the west fork of the south branch of the Chicago river at or near the bridewell, is about five and a half miles from the Desplaines river. That point which I have called the Continental Divide is about two miles from the Chicago river, or the south branch of the Chicago river.

1308 In case of a high raise in the Desplaines river and the Mud Lake region, the water originally went through the west fork and also part of it would go through the depression which I have stated led into the south fork of the south branch, but after the construction of the Illinois and Michigan Canal, that outlet was shut off by spoil banks. The elevation of that other divide is also between 10 and 11 at the divide.

Cross-Examination.

The WITNESS. The termination of the portage road at its end, and, which is nearest the Desplaines river is near the south line, between sections 1 and 12, township 38 north,
1309 range 12 east. It terminates there at the same place that it terminates on the McCullough map. By referring to the McCullough map, I guess I did probably draw it a little farther down. I mean I carried it a few hundred feet nearer to the Desplaines river but it was done unintentionally. On my map the Portage Road crosses the line between the two sections before it terminates; on the McCullough map it runs across the township range line between ranges 12 and 13.

Taking my map and taking into account the scale on
1310 which it is drawn, I guess I have carried the line about 300 feet farther than the McCullough exhibit carried it, but I would like to look up these field notes again of Mr. Walls'.

Objection renewed as to the introduction of the map. Whereupon the witness examined the field notes of John Walls and thereupon repeated his statement that the portage road on his map extended about 300 feet further than it extended on the McCullough exhibit, already introduced as Kramer Exhibit 1.

Whereupon counsel for the government directed Mr. Kramer to correct the error that he had made, by erasing that portion of the line which represented 300 feet; which direction was objected to by counsel for the defendant, on the ground that he desired the map to remain in its entirety as first introduced.

1312 Thereupon counsel for the government directed the witness to indicate with a pencil how far the portage road actually extended as corresponding with the McCullough exhibit introduced as Kramer Exhibit leaving the old marks on the map, but showing with a pencil mark where would be the correct termination of that line.

Whereupon the witness placed upon the mark "x" just west of the range line between ranges 12 and 13, as the termination of the portage road as shown on the government survey introduced as McCullough Exhibit 2 or Kramer Exhibit 1.

Re-direct Examination.

1313 The WITNESS. As corrected it now represents the portage road as shown on McCullough exhibit.

Counsel for the Government reoffered the map in evidence with the correction noted on it.

Objected to as incompetent, immaterial and irrelevant.

Mr. CRESSY. Q. What would you say as to the exhibit which is called Kramer Exhibit 6, being the topographical map of the Sanitary District which you say you con-
1314 structed in 1892 as explaining or corresponding with the exhibits already introduced, McCullough Exhibits 1 and 2, which have been called Kramer Exhibit 1; and the Orr Exhibits 2, 3, 4, and 6, which have been introduced in this case as Kramer Exhibit 2, in reference to the depressions, swamps and water courses lying between the Desplaines river and the Chicago river?

Objected to. The conclusions of the witness called for in this question are incompetent, irrelevant and immaterial.

The WITNESS. The colored part, that is, take, for instance, the neutral color and the red color, and the green color, the space occupied by these colors on this map correspond with the lakes and marshes shown in the exhibits heretofore introduced. For instance, it almost shows Portage Lake as Portage Lake is shown on the Mathewson exhibit; and it also shows the little depression which Mr. Mathewson had marked on his map as a depression extending east to the south fork of the south branch of the Chicago river; and it also would show by the contours the little space between the two streams which at that time are called the Continental Divide.

Re-Cross Examination.

1315 COUNSEL FOR DEFENDANT. It will save bringing the map out again.

The WITNESS. The elevation of the point which I speak of as the Continental Divide is 10.5. That is, I beg to amend that; between the elevations 10 and 11. The elevation of the Desplaines river above the elevation of the south fork of the south branch of the Chicago river is 8.0 at low water. It varies up to 11. I am just talking about the old datum; then it was 11.75, but in extreme high water time it runs

away up; it overflows the Continental Divide, as I have seen it myself in 1892 overflowing it.

Direct Examination Continued.

1316 The WITNESS. The map which is now handed me is a profile of the continental waterway from the Gulf of Mexico to the Gulf of St. Lawrence. The horizontal scale is 1 millimeter to one mile. The vertical scale is about 1 millimeter to two feet. I prepared this map, except the lettering, under the direction of Mr. Lyman E. Cooley, from government records, the report of the International Deep Waterway Commission for the year 1899, and also the records of the Sanitary District of Chicago. That is the only private concern whose records I have used. It was made about
1317 a year ago. From Chicago to the Gulf of St. Lawrence it is in the report of 1897; from Chicago to Joliet, the surveys of the Sanitary District of Chicago were taken; from Joliet to Grafton, the report of the Board of Engineers' Survey of 1905; from Grafton to Chain of Rocks, the charts of the Mississippi River Commission; from Chain of Rocks to the Gulf of Mexico, it was taken from this Board of Examination and Survey of the Mississippi river, 1909, all the way down. This map was prepared for the Deep Waterway Association and was their Exhibit 3, prepared about a year ago and it is accurate.

1318 All the points and depth also of water have all been verified from those various reports to which I refer.

The government tendered this profile.

Cross-Examination.

The WITNESS. The depths shown here of the Illinois and Desplaines rivers are taken from the profile of 1905. This legend up here "High water of 1904" means that it was shown on that profile of 1905 and the high water of 1904 on this profile indicates that the stage of the water in 1904 rose up to that point. I have testified that I did not put the lettering on his map; that was put on afterwards.

1319 This map was prepared on instructions from Mr. Cooley to prepare this profile. I don't know whether it was for the Deep Waterway Association, but I think it was, because we numbered it No. 3. There were a few more exhibits and this was No. 3.

COUNSEL FOR DEFENDANT. This map is objected to as incompetent, irrelevant and immaterial, and among other reasons because it purports to show depths of water after the natural condition of the river had been altered by first the Illinois and Michigan Canal, and secondly the Sanitary District Canal.

COUNSEL FOR GOVERNMENT. I will state for the record that the map does show as the objection states, the changed conditions after the construction of the Illinois and Michigan Canal and the Sanitary District; but we offer it in evi-
1320 dence at this time, admitting that it shows those changed conditions, and we asked to have it marked "Kramer Exhibit 7."

(Which said map so offered in evidence was marked "Kramer Exhibit No. 7.")

(Copy of Kramer Exhibit No. 7 appears in Appendix, p. .....)

THE WITNESS. The map now before me (Kramer Exhibit 7) represents the Desplaines river from Joliet to the mouth of the Desplaines river. I did not put that coloring there. The distance reading from the scale of the map is about fourteen miles I should say. The total length of the map, or the distance from the Gulf of Mexico to the Gulf of St. Lawrence, is 3,300 miles, and 15 of the 3,300 miles are represented by this pink band from Joliet to the mouth of the river.

The map now shown me is a profile of the lakes to the gulf waterway from Chicago to Cairo. The scale is 1 centimeter equals one mile horizontal; and 1 centimeter equals 10
1321 feet vertical. This profile was prepared by me about a year ago, for the purpose of showing the feasibility of a deep waterway between Lake Michigan and the Gulf. It shows the waterway, the Chicago river, Desplaines river, Illinois river and Mississippi river, from Chicago, Illinois, through the Drainage Canal, through the Desplaines river, through the Illinois river, and through the Mississippi up to Cairo. This map was compiled from surveys by the Sanitary District of Chicago, from Chicago to Joliet, from Joliet to Grafton, the report of engineers of 1905; from Grafton to the Chain of Rocks, from charts of the Mississippi River Commission from Chain of Rocks to Cairo, Board of the Examination and Survey of Mississippi River 1909.

This profile shows a continuous water course from Chicago to Cairo. It shows the depth of the streams and the water

lines, the different stages of low and high water and it also shows the declivities, the slopes of the river, depth of the water in the rivers. This map was prepared for the Lakes to the Gulf Deep Waterway Association, and it was their Exhibit No. 5.

The government offered this map in evidence.

Cross-Examination.

The WITNESS. This map would not show anything as affected by the Illinois and Michigan Canal; only as affected by the Sanitary and Ship Canal. It does show conditions not as they existed in nature, but as they existed after
1323 the Illinois and Michigan Canal and the Sanitary District Canal had been built. Down to Joliet, to Dam No. 1, the river bed was directly affected by the work done for the making of the Sanitary Canal and from that point it shows the depths as affected by the added flow from Michigan.

COUNSEL FOR DEFENDANT. The map is objected to as incompetent, immaterial and irrelevant, and particularly because it does not show the river or the depth of the river or the conditions of the river in its natural condition.

COUNSEL FOR GOVERNMENT. We admit that the map, for the purposes of the record, shows the conditions as they existed in 1904, after the changes had been made as indicated in the objections of counsel; but we offer the map in evidence and we ask to have it marked "Kramer Exhibit No. 8."

(Said map so offered in evidence was marked "Kramer Exhibit No. 8.")

(Copy of Kramer Exhibit No. 8 appears in Appendix, p. ——.)

Direct Examination Continued.

The WITNESS. The pink band on that map shows the
1324 profile of the Desplaines river from Dam No. 1 to its mouth, a distance of about 15.6 miles. From Chicago to Joliet, to Dam No. 1, it is 38.7 miles. From Chicago to the confluence of the Desplaines and the Kankakee rivers it is 54.3 miles. That is along the river, center thread of the river. From Chicago to the mouth of the Illinois river at Grafton it is 327.3 miles. From the mouth of the Desplaines to the mouth of the Illinois it is 273 miles. From the city of Chicago to the Mississippi river at St. Louis it is 364 miles

to Eads Bridge at St. Louis. The total distance within
1325 the State of Illinois is shown by the red band, the distance from Dam No. 1 at Joliet to the mouth of the Desplaines river to the mouth of the Illinois, 327.3 miles; 1/21 of the total distance. That would be about 5 per cent., one-twentieth would be 5 per cent. The distance from Lake Michigan to Cairo, Illinois, is 539 miles.

About 1/35 or about 3 per cent. of that 539 miles would be represented by the pink band between Dam No. 1, Joliet and the mouth of the river. The distance from Gulf to Gulf is 3,300. This pink band on Kramer Exhibit No. 7, would be about 1/300 of that total distance.

Q. Assuming that the Illinois river was a navigable
1326 river from its mouth to the confluence of the Desplaines and the Kankakee; assuming the Mississippi river to be a navigable river, and assuming that the Great Lakes and the St. Lawrence river are navigable waters of the United States and Canada; assuming that the Chicago Drainage Canal from the City of Chicago to Dam No. 1 at Joliet is a navigable water of the United States, what portion would the 15.6 miles which you have stated represents the distance of the Desplaines river from Dam No. 1 at Joliet to its confluence with the Kankakee occupy in reference to these navigable waters?

Objected to as containing assumptions not founded upon any evidence that has been presented in this case and which are contrary to the facts.

The Witness. It would be the connecting link between the two systems of waterways.

Counsel for Defendant. I move to strike out the answer as not responsive to the question; also as a conclusion of the witness on a matter on which his conclusion is not competent.

The Witness. It would be the connecting link between the navigable waters leading into the Gulf of Mexico and the navigable waters leading into the Gulf of St. Lawrence, providing the assumption is maintained that those waters are navigable.

1327 *Cross-Examination by Mr. Scott.*

The Witness. Walls was a United States deputy surveyor. I presume so because all the surveys—all government surveys are made by United States deputy surveyors, and if this sur-

vey was made by a contract the contractor would have to be a United States deputy surveyor. I do not know of my personal knowledge that Walls was a United States deputy surveyor, but I know the law in that case.

COUNSEL FOR DEFENDANT. I move to strike out beginning "but I know the law in that case" as not being responsive to the question.

The WITNESS. I do not know what the law was in 1821 in that particular.

I think I could take these field notes which have been
1328 offered in evidence and from those field notes run the lines. I mean that I could run these identical lines from these field notes. I could use them with sufficient accuracy, for which these notes were intended. There is nothing to indicate in the original field notes that the surveyor made any investigations as to the depths of water along the Desplaines river.

In making a survey of the character of the survey here in question, it was part of the surveyor's duty to ascertain whether or not the river was navigable or how far it was navigable, because he undoubtedly had instructions not to run his meander line any further than the head of navigation. I do not know any law that made it the duty of the surveyor in this instance to ascertain where the head of naviga-
1329 tion was, but take the Chicago river; it had been meandered the same way from the mouth up to the head of navigation, which was the point where the South Branch of the Chicago river split into two forks. I have no personal knowledge as to what instructions this surveyor had.

Under the original conditions the Desplaines river would have to rise in order to flow through into the Chicago river—well the ordinary stage of water in the Desplaines river was about 8.6, I should say, and the divide was 10.5, so it would only have to rise less than two feet.

Re-direct Examination by Mr. Cressy.

The WITNESS. I am familiar with the laws governing the actions of deputy United States surveyors as I was deputy surveyor myself.

1330 A river is always meandered up to the point where navigation stops. That has been my experience in the past, in Illinois, I don't know what the law has been before.

Objected to as incompetent, irrelevant and immaterial; that the law can not be proved by the testimony of this witness.

Re-Cross Examination by Mr. Scott.

The WITNESS. Being asked what rivers I have meandered for the government of the United States—I will say that I have never meandered any river for the government. And being further asked whether as deputy surveyor I gained no experience as to the point I have testified to, from actual practice, I will answer, no.

1331 THOMAS F. PARRY, called as a witness on behalf of the Government, testified as follows:

Direct Examination by Mr. Cressy.

The map now shown me, the basic map, is a topographical map furnished by the United States Geological Survey from Washington. I have added color to show the different planes of altitude. The contours are shown upon this map.
1332 All I have done is to color the contour lines as already shown on the map. The contour lines are shown in colors, representing the elevations as follows: light yellow is from sea level to 100 feet above sea level; in darker yellow it is from 100 to 500 feet above sea level; and green from 500 to 1000 above sea level; and brown from 1000 to 2000 above sea level; gray from 2000 above sea level; and a neutral color from 5000 to 10,000 above; and nearly black is 10,000 above sea level.

Certain figures that I have added at certain places represent altitude, defining various points on the divide between the lake system and the gulf system, the Mississippi river and its tributaries.

The sources from which I gained the date in reference to the elevations at these divides between the two systems, was from the report of the Deep Waterways Commission of 1896-1897, which is an official publication, as I understand it.
1333 Those elevations, beginning at the portage from Lake Superior to the head waters of the Mississippi river and going around the lake are the most northerly, going up

west of Duluth, 1281 feet above sea level; the next one, running between the Mississippi and Lake Superior is 1021; the next, that is from Green Bay over to the Mississippi, midway between Green Bay and the Mississippi, the Fox-Wisconsin, is 790 feet; the next, which is the Chicago Desplaines portage 591.9 feet; and the next, from the St. Joseph river to the Kankakee is 721. 708 is the one from the Wabash. I generally look at this with a magnifying glass; and the St. Joseph-Kankakee is 721 feet above sea level and the
1334 St. Joseph-Wabash 708. The next one, near Ft. Wayne, is 760 feet. That is the Maumee-Wabash. The next is the Miami river, that is also the Miami-Wabash—947 feet. I picked this out on a larger map and then put them on a smaller map for convenience. I don't think the name of the Maumee is given on that. Next is the Sandusky-Scioto, I think it is the Sandusky there; the Sandusky river
1335 which empties at Sandusky. That is 918. The other portages leading from Lake Erie to the Ohio river are all very much higher.

Q. As shown by that map and by your investigation, what is the lowest elevation between the Great Lakes and the Mississippi river, by the well known portages that formerly existed between these two systems?

Objected to as assuming a matter which is not defined and assuming something in the mind of the witness, which is not proven.

The Witness. The elevation of 591.9 of the Chicago divide is the lowest of the whole lot. The next lowest is the one nearest it, the Kankakee-Wabash, 708 feet.

The government offered that map in evidence and ask to have it marked "Parry Exhibit 1."

(Said map so offered in evidence was marked "Parry Exhibit No. 1.")

(Copy of Parry Exhibit No. 1 appears in Appendix, p. ——.)

Cross-Examination by Mr. Scott.

1336 The Witness. The figures that I submitted on there are taken from the report of the Deep Waterways Commission of 1896-1897, appointed by the President of the United States and which has made its official report. Mr. Lyman E. Cooley asked me to prepare this map and it was prepared about four or five months ago. It was not entirely made for

the purposes of this case. It is a regular official map from Washington. It was not primarily made for this case. The basic map is a regular official map from Washington. The main work on here is to show the fluctuations in the heights of the ridge between the Mississippi and the Gulf sys-
1337 tem of waters, for the purpose of this case. As to my occupation, I will say I am a topographical engineer, residing in Chicago.

Map objected to as incompetent, immaterial and irrelevant, and on the ground that no proper foundation is laid for the map itself.

Re-direct Examination.

Q. Was this one of the maps that were prepared for the Deep Waterway Association?

Objected to as leading.

The WITNESS. Yes, I believe it was, but these parts that you have asked about, these elevations, were not on here three or four months ago. I verified them; they were on very
1338 small, and I verified them, and enlarged them right after I left the Sanitary District in September, I think, of last year.

I am topographical engineer. I was in railroad engineering, starting in 1868 with the Cincinnati Southern Railway, and I went from them to the Santa Fe Railroad and I was with them two years; and I was on the extensions of the Union Pacific Railway in Omaha for a year; and was assistant chief draftsman in the Kansas City Engineer's office; and I came to Chicago and was with the Sanitary District, starting there about seventeen or eighteen years ago; and I left them to go with the United States Government as chief draftsman of the International Boundary Commission at El Paso, Texas. I came back from there and went back to the Sanitary District, but after four or five years I went back with the International Boundary Commission, State Department of the United States, and finished the work I had started a number of years before. The appropriation had run out before. I then came back to Chicago and went with the Sanitary District of Chicago, with whom I have been ever since up until September. My experience has been along the line of drawing profiles or topographic maps almost all the
1339 time. I have been in the field and in the office both. I have made profiles. I made a profile of the Mississippi

river from St. Paul to the Gulf from the Mississippi Commission maps, and my work in international boundaries was altogether the Rio Grande.

The map which is now shown me is a map of the Chicago Divide from the Chicago river to Lake Joliet made within the past three months by the City of Chicago, the Sanitary District of Chicago, and the United States Engineer Corps in 1885, 1892, scale horizontal one inch equals five thousand feet, that is nearly a mile; vertical, one inch equals twenty feet. I made that profile, under Professor Cooley's direction, for the purpose of introducing it in this case. It correctly delineates what it purports to be, a profile according to the data I examined in preparing it. I examined quite an amount of data in preparing it, and it correctly represents the Chicago Divide and the Desplaines river clear down to Lake
1340 Joliet.

COUNSEL FOR GOVERNMENT. We offer this map in evidence.

The WITNESS. The blue lines that are on this map, I secured from official data. The lines that are marked in red are historical more than anything else, for the purpose of locating those particular points. The reference to Mt. Juliet as shown here, Isle a la Cache, or Romeo Island, the 12-mile level as shown here, the word swamp, Portage Slough and the first Portage to La Petite Lac, and the second portage again, and the length of the whole portage, and also the location of Marquette's cabin. Otherwise all of the data on that map was secured from official data, from figures, notes and profiles that are in existence. These distances that are shown here, a great deal of it is measured distance and they have all been figured right from the profiles. They are official.

1341 *Cross-Examination by Mr. Scott.*

The WITNESS. I have no personal knowledge of where Marquette's cabin was. I have no personal knowledge as to the length of these various portages shown here. They were put on by instruction of Mr. Lyman E. Cooley. Here is the authority down here, compiled by Thomas S. Parry, under the direction of Lyman E. Cooley. That red matter I put down under his instruction, but the other matter is a matter of record. As to the matter in red, I have no personal knowledge.

COUNSEL FOR DEFENDANT. The map is objected to, as incompetent, irrelevant and immaterial, and as containing
1342 matter as to which there is no evidence in the record; and further as showing conditions existing in the river not in a state of nature, but as modified by subsequent improvement.

The WITNESS. The legend which is not in red ink, "Original Continental Divide prior to 1852," was ascertained by me from the map. "Assumed original bottom." That is in a dotted line; that is an assumption; it is marked "assumed." Assumed by Professor Cooley and myself, from the general lay of the land in that vicinity, from the topography as it appeared. The maps show that the ground run off about in that way on the original. I made investigation to satisfy myself that the "Assumed original bottom"
1343 conformed to the line I have drawn here and the original investigation consisted of looking at the topographical maps and seeing what seemed to me a line below what would have been the ordinary between. The line followed what I have assumed here within two or three feet of it. That probable flood line is a projection of this flood line of 1892, which is located by bench marks. By Professor Cooley's instructions I put "Probable flood line" on there. The high water line of 1892 is located by bench marks of the Sanitary District for high water, and that high water line is below the probable flood line at this point, about three feet. The ground was higher at that time and the probable flood line would have been higher then than it is now. The flood line of 1892 runs through there because the ground used to
1344 be lower there; or not lower; the ground was higher there; this was the probable former ground and the high water went above that ground, that is sure. I cannot tell at what period the ground was higher there. As to whether I put that probable flood line there simply because Prof. Cooley directed me to, will say, I would not have put it there unless I was pretty sure it was near correct. It could not have been far from there. The ground at that point, Kinzie avenue, is the same exactly, but it dropped off more abruptly to the east. Before it went over that way (indicating). Now the bottom is very much lower than it was at that time down here, so that the high water drops off like this. This high water land is absolutely located.

The period of the flood line put there in dotted lines,
1345 the probably flood line, probably antedating a hundred years ago, or eighty or ninety years ago, or two hundred years ago, or any time; six hundred years ago. I don't know that there is anything to indicate when the flood line changed from one point to another point, one elevation to another elevation. This map shows the elevation of the divide about 10.3 and it shows the elevation of the probable flood line at about 12 feet. That would make the flood line about 1.7 feet higher than the elevation of the divide. The 1892 line is the line that is taken from notes. That slope that I have put there, the probable flood line is an arbitrary
1346 line. It cannot be computed. I don't know how wide an area that probable flood line covers. In order to ascertain the slope it would not be necessary to know the area from which the water was discharged, because it goes off to the flat of the lake. It would make a difference how wide an area it covered in getting the flat of the lake. It would be necessary to know the area in order to compute the flood line. I did not make any effort to ascertain the area from which the water was discharged.

Re-direct Examination by Mr. Cressy.

The WITNESS. The line is dotted, showing it is a hypothetical line; and it is marked "probable flood line." It is not intended to be accurate.

Re-cross Examination by Mr. Scott.

1347 The WITNESS. The probable flood line I have shown there would indicate at flood 1.7 feet over that divide.

1347 COUNSEL FOR GOVERNMENT. I will ask to have this marked "Parry Exhibit 2."

COUNSEL FOR DEFENDANT. I object to Mr. Cooley who is now conversing with the witness, and has instructed him to measure up the distance between the flood line and the elevation of the divide, the witness still being on the stand and under examination.

(Said map so offered in evidence was marked "Parry Exhibit 2.")

1348 LYMAN E. COOLEY, called as a witness on behalf of the government, testified as follows:

My name is Lyman E. Cooley; my age, 60 years; my residence, Evanston, Illinois; my occupation, civil engineer by education and profession, with an office in the City of Chicago. I have been in the practice of my profession for 36 years. I was engaged as a professor teaching civil engineering at the Northwestern University from the time I graduated in 1874 up to 1875; also as the editor of the "Engineering News" from 1875 to 1878, or rather associate editor; and in 1878 I became assistant engineer in the construction of the bridge across the Missouri river at Glasgow for
1349 the Chicago & Alton Railway. Later in the same year I became attached to the River and Harbor Service of the War Department, in which I continued until late in 1884, holding the position of resident engineer at Nebraska City, Nebraska, on the Missouri river, and at St. Charles, Missouri, also on the Missouri river, in charge of surveys on the Mississippi river near Plum Point, and chief assistant in the office in general charge of thirteen works, and in general charge of physical research upon the streams of the Mississippi valley.

I came to Chicago originally in 1874. After my experience on the Missouri river, I came back in 1884 and was engaged as editor of the "American Engineer" until 1885.

I am familiar with the Desplaines river. In the summer and fall of 1885 I had occasion to make an examination of conditions in the Desplaines valley and across the Chicago divide, as a member of a committee of the Citizens' Association charged with the duty of recommending some measure for the solution of the sanitary problem of Chicago. Following that report, a drainage and water supply com-
1350 mission was constituted, of which I was chief assistant in 1886 and 1887, and had charge of all the surveys and physical investigation in the field with respect to the route of a drainage canal, the phenomena of the Desplaines river valley and of lake currents in Lake Michigan.

In 1888 and 1889, and again in 1891, I was consulting engineer of the State Board of Health of Illinois, engaged in studying several streams of Illinois with respect to their water supply, including the Desplaines river. I was mean-

time consulting engineer to the mayor of the city in which the investigations were continued; and for the joint committee of the legislature which framed the Sanitary District law in 1888 and in 1889; and following that of the commission that determined the boundaries of the Sanitary District in 1889.

I became the first chief engineer of the Sanitary District and directed further surveys and investigations of the Desplaines river valley. In 1891 I became a Trustee of the Sanitary District. In 1897 I was consulting engineer of the Sanitary District and also a member of the Intercepting Sewer Commission of the City of Chicago; and in 1901 I was a member of the committee to prepare a comprehensive plan for the completion of the works of the Sanitary District. Since then, in 1906 and 1909, I have had occasion to review this matter at greater or less length in connection with my duties as secretary and consulting engineer for the Internal Improvement Commission of Illinois.

1351 In 1895 to 1897 I was a member of the International Deep Waterways Commission which had for its object the determination of the feasibility of extending ocean navigation from the Atlantic to the head of the Great Lakes at Chicago and Duluth, and collected and made a study of all existing profiles and maps and data respecting the Great Lakes.

In 1898 I was the consulting engineer of a group of ten contracting firms that thought they might wish to undertake the construction of the Isthmian canal, and for that body of men I made a trip to Panama and Nicaragua and made a set of plans and estimates for the construction of an Isthmian canal.

In 1898 I was the advising engineer of Governor Black's Commission of New York upon an investigation of the expenditure of $9,000,000 for the improvement of the Erie and other canals of New York State.

1352 I have already referred to my connection with the "Engineering News" and the "American Engineer." I have written numbers of special papers in addition to reports relating in particular to the lakes-to-the-gulf waterway, and contributed the article upon canals to "Werner's American Edition of Britannica," and the article on dams to the "Encyclopaedia Americana."

I am a member of the American Society of Civil Engineers, and I have been a member of the Western Society of Engineers for 35 years and twice its president; a member of the

Chicago Academy of Sciences, and the American Geographical Society, and some other organizations.

I have stated I was familiar with the Desplaines river since about 1884; I am also familiar with what is known as the Desplaines river basin, namely, the topography of the country surrounding the Desplaines river and its general physical conditions.

In reference to my knowledge and experience in relation to the question of the flow of water in streams, and the influences which tend to affect or control the same, as I have

1353 stated, I have made pretty full studies of the Desplaines river basin, and of other streams of Illinois; I have had occasion to study the habits of streams and the relation of their run-off, in the upper Mississippi basin, in connection with the reservoir systems, as early as 1882; and at that time I also made a study of the great lakes as a great natural reservoir which could be adapted or utilized in producing a waterway between the lakes and the Mississippi river. I have also made studies of a number of streams in connection with water-power propositions and flood protection.

Some of the elements that the expert engineer has to take into account in solving a problem such as water supply for a city, or controlling the flow volume of a stream, are the character of the basin with respect to its topography, and its soil, and the amount of control which such basin naturally has, such as the forests and bogs and marshes and lakes, and the amount of control which it may be able to produce in that basin by artificial works; and it really amounts to a complete study of the habits of the stream with respect to its variation of run-offs throughout the year.

Referring to other projects where I had to consider

1354 similar questions, I would mention the Muskegon river in Michigan, of which I made a very full study in connection with water power; the Huron river in Michigan; the Grand river for both water power and flood protection for the City of Grand Rapids; also the St. Joseph river and the Genesee river in the State of New York; and the Mississippi river again in connection with the proposed water power development at Keokuk and Hamilton; at the foot of the Des Moines rapids; and of the south fork of the South Platte in connection with the water supply for the City of Denver, and some others.

I have made a study along these same lines of the Des-

plaines river basin. To state what I have done in reference to determining these questions which I say an expert engineer must take into consideration in considering a project from an expert standpoint, I would say that I established a gauge at Riverside in May, 1886, and at other points on the stream, above and below, and a continuous record, with some breaks, has been kept at the Riverside gauge from 1886 down to this time. I also made observations upon the flow of water at the Riverside gauge in 1886 and 1887 and established the rating of the gauge so that the volume of water could be determined for that point by knowing the height upon the gauge.

1355 I have extended surveys upon the flood planes of the Desplaines river as far as Feehanville, with a view of studying some characteristic floods in that valley, like the one of 1881 and the one of 1887.

I have been over a large part of the river from there up to the Wisconsin line and have been over the river below Riverside a number of times; have supervised most of the general surveys made in that part of the valley, and have made measurements at Joliet and taken the flood volumes at that point, and also upon the overflow waters directed toward Chicago. I have also had made a topographical map that covers the most of the Desplaines river basin in Cook County, and consulted all other maps that I knew of of a similar nature respecting other parts of the basin.

I have made a study of the conditions of the soil in the Desplaines river basin. I have gathered data respecting the conditions of swamps and forests as they originally existed, as near as might be.

The Desplaines river rises near the county line between Racine and Kenosha counties, Wisconsin, and runs in a southerly direction, parallel substantially to the west shore of Lake Michigan, through Lake County and Cook County

1356 until it reaches Riverside, some eleven miles from the mouth of the Chicago river; thence it takes a southwesterly direction through Cook and Will counties to the confluence with the Kankakee river near the east line of Grundy County.

I have computed the area of the Desplaines river basin, first in its original state and then in its later state after there had been certain alterations and changes made in that basin. The original area of the Desplaines river basin was

1428 square miles, and with the changes which have been made, the present area is taken at 1392 square miles.

The Desplaines river basin is usually divided into the upper Desplaines and the lower Desplaines, the term upper Desplaines applying to that portion above Riverside. The characteristics of the upper Desplaines basin above Riverside are that it has an area of 633 square miles, a general length of 60 miles, and a general width of about 10 miles, and is a true river basin, has practically no true tributary basins, except Salt Creek has about 110 miles, entering at Riverside.

It is a rolling country, originally covered with one-
1357 third to one-half in timber. Its general declivity by its flood plane is about one and a half feet per mile. The river bed is cut as a groove in the prairie, rather than the ordinary river bed, with an overflow or flood plane on either side. Originally it had a considerable proportion of swamp, marsh and bog at head waters; and in Lake County and in portions of Cook County, and also upon Salt Creek in Du Page County; and a lake development in Lake County from which Lake County takes its name.

The characteristics of the lower Desplaines basin, that portion below Lyons or Riverside, are that it covers by the general course of the valley about 42 miles to the confluence with the Kankakee, and has a total descent of about 102 feet to 103 feet. It has a true sub-basin in the Du Page river which covers 36 square miles. The total area is 795 square miles below Riverside, but outside of the Du Page river this area is only 429 miles. The valley is not in itself a characteristic valley like the upper Desplaines but has the appearance of being an old water course or outlet from the great lakes in which the modern stream follows through remnants of an ancient stream of much greater magnitude, a succession of pools and wide expanses with intermediate channels,

which have not yet developed to their proper propor-
1358 tions, connecting these pools and water stretches. The river valley or river has two considerable tributaries aside from the Du Page, in Hickory Creek and Jackson Creek, but otherwise the drainage is essentially marginal or shore drainage.

The characteristic of the river itself through this basin is that the river beginning within a mile of the township line between Riverside and Lyons, T. 38, 9 North, is a long level expanse known as the twelve mile level extending to within a mile and a half of the Lemont highway and consists of a

succession of water expanses and connecting straits or channels from 150 feet up to a quarter or even an eighth of a mile in width, in places, and with varying depths up to 10 or 15 feet in localities; these water expanses having a mud bottom which seems to be more vegetable deposits than alluvial, and which indicate originally much greater depth; and margined in by a vegetable growth. These expanses were for a long time used as ice fields by the ice interests which had their market in Chicago.

Below the twelve mile level is a succession of ponds and shallow connections in the rock, like Goose Lake and Round Lake, and others between Romeo and the twelve mile level. This whole stretch I think is well described in the original land survey as a succession of swamps, ponds, lakes and marshes connected by current.

1359 Below Romeo there is a declivity at the rate of 7 feet per mile from the Romeo highway down to the head of Lake Joliet, a distance of eleven miles, pretty uniformly distributed. Thence for a distance of about thirteen miles between that and the mouth of the river we have some ten miles occupied by pools, or Lake Joliet, which has a length of nearly six miles and has a width of 500 to 900 feet, and a depth originally up to 15 or 20 feet; and then a pool of over a mile in length immediately below the Treat's Island rapids; then Lake Du Page, some three miles in length, with a width of about 350 feet on the average, and with a depth of ten feet and upwards, these pools being connected by intermediate rapids like the one at Treat's Island and the one near the mouth of the Kankakee, and the reach of swifter and shallower water between the pool below Treat's Island and the head of Lake Du Page.

As to when I first became aware of these conditions which I have just described, in reference to the upper and lower Desplaines river basin and the Desplaines river itself, it seems as if I almost knew something about it from the time that I came into this country because I did make a study of some features of a waterway problem as early as 1875, pertaining to the lower Illinois, and was at that time familiar with

1360 the profile of the river; but particularly since 1885. In 1885 I was then acting for the Citizens' Association of Chicago, and later in 1886 and 1887 I was acting officially for the City of Chicago. The description which I have just given applies to the Desplaines river as it was known say up to 1892 or 1893-1894, when the Sanitary District works changed

the conditions very radically through the valley above the City of Joliet, between there and Lyons.

Referring to what has been designated as the upper Desplaines river basin, the amount of water in this river has been measured, or rather, a gauge record has been kept from which the measurements have been computed. The gauge record began in May, 1886; I established it in that month of that year, and made the measurements upon which the rating of the gauge is based, and that record has been continuous with some breaks—or has been continuous since 1892, but is somewhat fragmentary between 1886 and 1892. There is, however, out of the 25 years a complete record for 20 full years.

1361 This Riverside gauge record, about which I have just been testifying, appears as part of Executive Document No. 263, being a report to the House of Representatives of the 59th Congress, first Session, upon a survey, "with plans and estimate of cost for navigable waterway 14 feet deep from Lockport, Illinois, by way of the Desplaines and Illinois rivers, to the mouth of said Illinois river," etc., by the Mississippi Rivers Commission—so much of it was taken prior to 1905. I have secured the data for the years from 1904 down to the close of 1910, for the purpose of completing the table, from the Sanitary District of Chicago. I have taken these gauge records from House Document 263 and from the records of the Sanitary District from 1904 down to date, and computed the duration of the water at certain given stages at this gauge, so as to bring out the number of days at

1362 which the water stood at or above a certain elevation and at or above a certain volume. This table which is now shown me is the computation which I have made covering a record of 24 years of the Riverside gauge between the years 1887 and 1910 inclusive. I have made this myself in part and part with the aid of my assistants. I can testify that it is accurate and reliable. It contains a record for all the years which have a full record, but not of the partial years. There were twenty full years in that period of twenty-five years. In other words, there are four years that have been omitted because the gauge was not complete for those years. There is one year in which there was no record at all, and the other years are partial. In the years that I have stated in this table the record is perfectly complete.

To explain the table, I would state that in the first

1363 column of the table is given the twenty years for which we have the full record, and opposite these years is

given the precipitation of rainfall and snowfall for each of the twenty years, in inches.

The next column, designated "a" at the head, represents number of days at which the Riverside gauge stood at or above an elevation of 18 feet, and corresponds to a volume of 4500 second feet, said stage of water corresponding to the height of the spillway built by the Sanitary District at 16.25, and to an elevation of 13.6 to 14 feet in the 12 mile level at Summit.

The fourth column marked "b" gives the number of days at which the Riverside gauge stood at or above 13.8 feet, corresponding to a volume of 1052 second feet; the corresponding elevation in the 12 mile level being 11.73 feet, or the crest of the Ogden-Wentworth dam on the range line at Summit.

The fifth column, marked "c," represent the number of days at which the gauge stood at or above 13 feet at Riverside; corresponding to a volume of 600 second feet or above, and to an elevation of 10.5 feet in the 12 mile level of the river at Summit.

The sixth column, marked "d," represents the number of days at which the gauge at Riverside stood at or above 12.4 feet; corresponding to a volume of 305 second feet and to an elevation of 9.6 feet at the head of the 12 mile level at Summit.

1364 The seventh column, marked "e," represents the number of days at which the Riverside gauge stood at or above 11.85 feet, corresponding to a volume of 100 second feet, or 8.8 to 8.9 feet in the 12 mile level near Summit.

The eighth and last column represents the yearly run-off for such years as it has been actually figured, but includes only eight of the twenty years.

The zero of the Riverside gauge is at Chicago datum and the elevations read up from Chicago datum. The actual low water, or lowest water about 11 feet on the gauge; these elevations all refer to Chicago datum.

Referring to document No. 263, page 511, and particularly to the expression "Gauge readings, Illinois and Desplaines rivers, Riverside gauge," in which on page 511 it gives
1365 the records for 1886 and so on, to page 520, where it gives the record for 1904, I would state that those pages were used in computing my records for the years 1886 to 1904.

Whereupon counsel for the government offered said pages 511 to 520 in evidence. Said pages are as follows:

1365a GAUGE READINGS, ILLINOIS AND DES PLAINES RIVERS, ILLINOIS.

(61) Riverside Gauge.

This gauge is spiked to an elm tree on the left bank of the Des Plaines River, about 200 feet below the hotel, a short distance above the outlet of a large sewer, and opposite the residence of Mr. Page.

The "new gauge," established on January 3, 1887, was set with its zero at Chicago city datum, or elevation 587.04 feet, Memphis datum. It has been the intention since that time to maintain it at that elevation, but during a portion of the time it was 0.04 feet lower, as shown by the elevations at the top of the tables.

The readings which were taken on the "old gauge" from May 13, 1886, to January 3, 1887, were corrected so as to refer to Chicago city datum, so there is no necessity for giving the elevation of the old gauge.

Gauge readings, Illinois and Des Plaines rivers, Illinois.

Riverside, Ill.

1886.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; elevation of zero, 587.04; gauge read by T. E. Bryant, May 15 to June 5; J. S. Driver, June 5 to Sept. 11; T. E. Morford, Sept. 11 to Dec. 11; William Kirkham, Dec. 4 to 31; copied by R. L. Hauser from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1						12.17	11.87	11.31	11.72	11.34	11.40	11.12
2						12.12	12.02	11.30	11.77	11.34	11.37	10.97
3						12.42	12.22	11.28	11.52	11.34	11.15	10.95
4						12.32	12.27	11.22	11.47	11.36	11.30	10.87
5						12.22	12.27	11.17	11.37	11.32	11.12	10.97
6						12.07	12.22	11.22	11.42	11.33	11.07	10.82
7						11.97	12.15	11.19	11.28	11.17	11.07	10.82
8						11.87	12.13	11.17	11.27	11.17	11.09	10.87
9						11.87	12.18	11.15	11.28	11.07	11.17	10.87
10						11.82	12.04	11.15	11.30	11.07	11.27	10.87
11						11.77	11.88	11.13	11.35	11.07	11.27	10.87
12						11.72	11.87	11.14	11.35	11.07	11.32	10.97
13						11.72	11.77	11.11	11.42	11.07	11.27	11.32
14						11.72	11.76	11.22	11.40	11.07	11.27	11.32
15					14.67	11.67	11.78	11.25	11.34	11.04	11.27	11.27
16					15.32	11.67	11.70	11.42	11.27	11.09	11.27	11.17
17					15.27	11.77	11.67	11.34	11.27	11.07	11.27	10.77
18					15.07	11.77	11.58	11.35	11.29	11.09	11.27	11.07
19					14.97	11.77	11.58	11.36	11.42	11.17	11.07	11.02
20					14.92	11.72	11.54	11.32	11.41	11.17	11.32	11.02
21					14.77	11.67	11.52	11.41	11.97	11.17	11.47	11.37
22					14.27	11.67	11.47	11.67	12.02	11.07	11.46	11.17
23					13.52	11.57	11.42	11.57	11.62	11.07	11.17	11.17
24					13.02	11.52	11.45	11.55	11.50	11.07	11.17	11.15
25					12.92	11.47	11.43	11.42	11.43	11.07	11.07	11.09
26					12.62	11.55	11.52	11.36	11.38	11.09	11.05	10.95
27					12.62	11.52	11.40	11.27	11.49	11.40	11.19	10.95
28					12.52	11.55	11.27	11.27	11.35	11.49	11.07	10.97
29					12.52	11.77	11.17	11.52	11.32	11.75	11.07	10.92
30					12.37	11.87	11.12	11.57	11.32	11.62	11.07	11.02
31					12.32	.....	11.10	11.52	.....	11.48	.....	10.97

No discharge from July 27 to August 19, September 7 to 17, September 28 to October 26, and November 2 to December 31.

1365B Gauge readings, Illinois and Des Plaines rivers, Illinois—Continued.

Riverside, Ill.—Continued.

1887.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m.; elevation of zero, 587.04; gauge reader, William Kirgham; copied by R. L. Hauser from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	10.97	14.50	13.90	12.60	12.20	11.65	11.20	12.10	11.85	12.35	12.35	.....
2	11.09	14.20	14.30	12.75	12.05	11.60	11.10	12.00	11.80	12.55	12.35	.....
3	11.17	14.00	14.90	12.95	12.00	11.50	11.20	11.95	11.80	12.65	12.35	.....
4	11.30	13.80	15.05	13.05	11.95	11.50	11.25	11.85	11.80	12.65	12.35	12.75
5	11.20	13.60	15.40	12.95	11.90	11.55	11.15	11.80	11.85	12.70	12.35	12.80
6	11.20	13.30	15.10	12.90	11.90	11.65	11.10	11.70	11.85	12.70	12.40	12.80
7	11.20	13.30	14.90	12.80	11.95	11.65	11.05	11.75	11.85	12.75	12.45	13.50
8	11.20	17.20	15.90	12.85	11.90	11.55	11.10	11.70	11.85	12.80	12.55	13.85
9	11.20	20.00	16.30	12.75	11.80	11.50	11.05	11.70	11.85	12.85	12.55	13.90
10	11.25	19.70	16.25	12.70	11.85	11.50	11.00	11.70	11.85	12.80	12.55	13.85
11	11.20	18.80	15.95	12.60	11.75	11.45	11.00	11.80	11.85	12.75	12.50	13.85
12	11.00	17.90	15.00	12.50	11.75	11.40	11.00	11.80	11.85	12.75	12.45	13.85
13	11.10	17.90	15.60	12.50	11.75	11.45	11.10	11.80	11.90	12.70	12.45	13.80
14	11.10	16.95	15.95	12.40	11.70	11.40	11.05	12.05	12.10	12.70	12.45	13.75
15	11.15	16.30	15.40	12.30	11.70	11.35	11.05	12.00	12.15	12.70	12.40	13.70
16	11.10	16.05	14.90	12.20	11.75	11.35	11.05	11.95	12.10	12.65	12.40	13.70
17	11.15	15.75	15.05	12.25	11.65	11.30	11.00	11.95	12.05	12.60	12.35	13.70
18	11.30	18.00	14.70	12.15	11.60	11.30	12.95	11.90	12.00	12.60	12.35	13.70
19	11.15	18.15	14.15	12.15	11.55	11.20	12.90	11.90	12.00	12.55	12.30	13.75
20	11.05	17.40	13.90	12.00	11.60	11.05	12.95	11.85	12.00	12.45	12.30	13.80
21	11.10	16.85	13.70	12.10	11.65	11.40	12.85	11.95	12.00	12.35	12.25	13.85
22	11.30	16.30	13.50	12.05	11.70	11.40	12.80	12.00	12.05	12.35	12.30	13.90
23	15.50	15.70	13.30	12.00	11.70	11.40	12.80	11.95	12.00	12.45	12.35	13.80
24	15.25	15.30	13.10	12.10	11.75	11.40	12.80	11.90	12.00	12.55	12.40	13.80
25	14.35	15.10	13.00	12.40	11.65	11.30	12.75	11.85	12.00	12.55	12.45	13.75
26	14.28	14.20	12.95	12.30	11.60	11.20	12.70	11.90	12.00	12.50	12.55	13.70
27	15.45	14.80	12.80	12.20	11.65	11.15	12.70	11.95	12.20	12.45	.....	13.70
28	14.60	14.75	12.60	12.30	11.65	11.10	12.65	11.85	12.15	12.45	.....	13.65
29	14.60	.....	12.70	12.30	11.55	11.20	12.60	11.80	12.15	12.40	.....	13.65
30	14.40	.....	12.45	12.25	11.55	11.20	12 55	11.85	12.25	12.40	.....	13.60
31	14.55	.....	12.50	.....	11.60	.....	12.20	11.85	.....	12.40	.....	13.60

No discharge from January 1 to 22, and June 15 to July 17.

1365c 1888.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m.; elevation of zero, 587.04; gauge reader William Kirkham; copied by R. L. Hauser from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	13.60	13.35	16.95							10.95	10.85	10.45
2	13.60	13.40	16.85						11.95	10.90	10.85	10.40
3	13.60	13.45	16.75						11.90	10.90	10.85	10.35
4	13.65	13.40	16.60						11.85	10.85	10.85	10.30
5	13.65	13.35	16.30						11.80	10.80	10.90	10.25
6	13.65	13.30	16.00						11.70	10.80	10.95	10.20
7	13.65	13.30	15.60						11.60	10.80	11.00	10.15
8	13.65	13.25	15.20						11.60	10.80	11.00	10.10
9	13.65	13.25	14.85						11.55	10.75	11.00	10.05
10	13.60	13.20	14.85						11.50	10.75	11.00	10.00
11	13.60	13.20	14.65						11.45	10.75	11.00	10.00
12	13.60	13.25	14.45						11.40	10.80	11.00	9.90
13	13.55	13.35	14.35						11.40	10.85	11.00	9.80
14	13.55	13.35	14.40						11.35	10.90	11.00	9.75
15	13.50	13.40	14.35						11.30	10.95	11.00	9.65
16	13.50	13.45	14.30						11.35	10.95	11.00	9.60
17	13.50	13.50	14.40						11.40	10.95	11.00	9.60
18	13.45	13.60	14.40						11.50	10.95	11.00	9.55
19	13.45	13.90	14.85						11.50	10.95	11.00	9.50
20	13.40	14.45	15.20						11.45	10.95	11.00	9.50
21	13.40	15.85	16.30						11.35	10.95	11.00	9.45
22	13.35	15.65	17.10						11.25	10.95	10.95	9.50
23	13.35	14.85	16.85						11.20	11.00	10.95	9.55
24	13.30	15.10	16.70						11.15	11.00	10.95	9.65
25	13.30	16.60	16.75						11.10	11.00	10.95	9.70
26	13.30	16.70	16.85						11.05	11.00	10.95	9.75
27	13.30	16.70	16.90						11.05	11.00	10.85	9.80
28	13.30	17.00	16.70						11.00	10.95	10.75	9.95
29	13.25	.....	16.20						11.00	10.90	10.65	10.10
30	13.20	.....	15.80						11.00	10.85	10.55	10.30
31	13.25	.....	15.65						.....	10.85	.....	10.40

No discharge from September 21 to December 31.

1365D Gauge readings, Illinois and Des Plaines rivers, Illinois—Continued.

Riverside, Ill.—Continued.

1889.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m. (read at 6:30 a. m. from May 5 to July 7); elevation of zero, 587.04; gauge reader, William Kirkham; copied by R. L. Hauser from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	10.55	11.85	10.20	11.90	12.30	11.90	13.95	14.10	10.90	11.35	11.35	11.10
2	10.70	11.75	10.30	12.00	12.20	11.80	13.65	13.85	10.80	11.30	11.35	11.20
3	10.85	11.65	10.40	12.15	12.10	11.70	13.55	13.55	10.70	11.25	11.35	11.30
4	10.95	11.55	10.85	12.05	11.95	11.60	13.45	13.30	10.60	11.25	11.35	11.40
5	11.10	11.45	11.30	11.95	11.85	11.50	13.75	13.10	10.60	11.25	11.35	11.50
6	11.10	11.40	13.10	11.85	11.75	11.55	13.85	12.95	10.70	11.20	11.35	11.60
7	11.10	11.30	13.25	11.75	11.65	11.65	11.85	12.85	10.80	11.20	11.35	11.70
8	11.15	11.20	13.25	11.65	11.55	11.80	11.65	12.75	10.95	11.25	11.35	11.75
9	11.25	11.15	13.20	11.55	11.45	11.80	11.45	12.65	10.95	11.25	11.45	11.70
10	11.35	11.00	13.20	11.45	11.35	12.00	11.35	12.55	10.85	11.25	11.45	11.80
11	11.50	10.95	13.10	11.50	11.25	12.20	11.25	12.45	10.80	11.30	11.40	11.90
12	11.60	10.85	12.95	13.60	11.65	12.40	11.20	12.35	10.70	11.35	11.35	12.00
13	11.75	10.75	12.85	14.20	12.10	12.75	11.25	12.25	10.70	11.35	11.35	12.10
14	11.85	10.65	12.70	14.40	12.75	13.20	11.85	12.15	10.60	11.25	11.30	12.10
15	11.95	10.65	12.60	14.35	12.85	13.85	13.20	12.20	10.50	11.25	11.30	12.10
16	12.10	10.75	12.50	14.10	12.90	13.95	13.80	12.10	10.50	11.20	11.30	12.10
17	12.30	10.85	12.45	13.80	12.80	13.70	13.35	11.95	10.60	11.15	11.35	12.20
18	12.50	10.85	12.35	13.80	12.80	14.00	13.00	11.65	10.70	11.10	11.35	12.30
19	12.70	10.75	12.25	14.00	12.90	14.95	12.85	11.50	10.80	11.05	11.30	12.40
20	12.90	10.65	12.15	14.15	12.90	15.10	12.65	11.35	10.90	11.00	11.20	12.50
21	12.85	10.55	12.00	14.30	12.80	15.45	12.55	11.25	11.00	10.90	11.10	12.60
22	12.75	10.45	11.95	14.20	12.65	14.65	12.35	11.15	11.10	10.80	11.00	12.75
23	12.65	10.35	11.85	14.00	12.55	14.20	12.10	11.00	11.25	10.85	10.95	12.80
24	12.55	10.30	11.75	13.90	12.45	13.75	11.95	10.90	11.20	10.95	10.85	12.90
25	12.45	10.25	11.65	13.75	12.35	13.65	11.85	10.80	11.20	11.00	10.75	12.85
26	12.35	10.20	11.55	13.45	12.20	13.70	11.75	10.70	11.20	11.10	10.75	12.80
27	12.35	10.15	11.50	13.20	12.00	13.80	11.65	10.60	11.30	11.15	10.85	12.75
28	12.25	10.15	11.65	13.20	11.90	13.90	16.65	10.65	11.40	11.20	10.95	12.70
29	12.15	.....	11.75	13.00	11.80	14.00	14.95	10.75	11.40	11.20	10.95	.....
30	12.05	.....	11.85	12.65	11.90	14.00	14.85	10.85	11.40	11.35	11.00	.....
31	11.95	.....	11.85	.....	11.95	.....	14.35	10.90	.....	11.35	.....	.....

No discharge from January 1 to 10, February 6 to March 5, July 10 to 13, August 20 to November 9, and November 11 to December 4.

1365E 1890.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m. (read at 6:30 a. m. from Aug. 24 to Oct. 12, and at 6:15 a. m. from Oct. 12 to Nov. 23); elevation of zero, 587.04; gauge reader, William Kirkham; copied by R. L. Hauser from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1								11.42	11.52	11.30	11.60	11.50
2								11.38	11.48	11.35	11.60	11.52
3								11.28	11.55	11.42	11.50	11.55
4								11.35	11.48	11.40	11.48	11.60
5								11.32	11.48	11.40	11.48	11.60
6								11.65	11.52	11.45	11.45	11.60
7								11.55	11.50	11.48	11.45	11.60
8								11.48	11.52	11.48	11.48	11.60
9								11.60	11.50	11.45	11.48	11.70
10								11.40	11.52	11.45	11.48	11.65
11								11.50	11.42	11.45	11.52	11.60
12								11.48	11.40	11.48	11.52	11.55
13								11.30	11.42	11.48	11.45	11.50
14								11.30	11.38	11.48	11.85	11.48
15								11.25	11.38	11.48	11.40	11.48
16								11.55	11.55	11.55	11.50	11.68
17								11.42	11.65	11.42	11.60	11.55
18								11.45	11.52	11.48	11.60	11.50
19								11.45	11.40	11.50	11.60	11.40
20								11.45	11.35	11.45	11.60	11.55
21								11.48	11.40	11.40	11.60	11.40
22								11.42	11.38	11.42	11.60	11.40
23								11.58	11.40	11.48	11.62	11.55
24							11.80	11.35	11.45	11.52	11.62	11.55
25							11.75	11.38	11.40	11.55	11.58	11.50
26							11.72	11.35	11.38	11.58	11.52	11.40
27							11.60	11.65	11.32	11.58	11.50	11.40
28							11.70	11.60	11.32	11.60	11.60	
29							11.75	11.55	11.38	11.62	11.52	
30							11.68	11.50	11.32	11.62	11.50	
31							11.45	11.48		11.62		

No discharge from August 2 to 5, 13 to 15, and 24 to 26, and September 14 and 15.

1365F Gauge readings, Illinois and Des Plaines rivers, Illinois—Continued.

Riverside, Ill.—Continued.

1892.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m.; elevation of zero, 587.04; gauge reader, William Kirkham (by J. D. Raynolds from May 3 to 11); copied by R. L. Hauser from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1						14.60	13.90	11.70	11.50	11.40	11.45	11.50
2						14.95	13.50	11.70	11.45	11.40	11.45	11.50
3					16.25	15.10	15.20	11.65	11.40	11.40	11.45	11.50
4					16.60	15.05	15.40	11.60	11.40	11.40	11.45	11.50
5					17.55	14.80	14.70	11.57	11.40	11.40	11.45	11.50
6					20.20	14.55	14.00	11.60	11.40	11.40	11.45	11.52
7					19.15	14.50	13.40	11.52	11.40	11.40	11.45	11.57
8					17.70	16.30	13.00	11.55	11.40	11.40	11.50	11.62
9					16.90	16.60	12.70	11.55	11.40	11.40	11.50	11.65
10					15.90	16.30	12.55	11.55	11.40	11.40	11.50	11.65
11					15.20	15.50	12.57	11.55	11.55	11.40	11.50	11.60
12					14.90	14.90	12.70	11.50	11.65	11.40	11.50	11.55
13					14.70	14.60	12.50	11.47	11.70	11.40	11.50	11.55
14					14.70	16.00	12.45	11.45	11.65	11.40	11.50	11.60
15					14.70	16.60	12.37	11.42	11.60	11.40	11.55	11.60
16					14.60	15.50	12.20	11.42	11.50	11.40	11.55	11.60
17					14.20	14.90	12.05	11.42	11.50	11.40	11.55	11.60
18					13.70	15.00	12.00	11.40	11.50	11.40	11.60	11.70
19					14.40	16.80	11.90	11.40	11.45	11.40	11.60	11.75
20					16.00	18.30	11.90	11.40	11.45	11.40	11.60	11.70
21					15.80	18.25	11.80	11.40	11.40	11.40	11.60	11.60
22					15.30	16.80	11.80	11.40	11.40	11.40	11.55	11.52
23					14.85	16.75	11.77	11.40	11.40	11.40	11.50	11.50
24					14.50	a20.55	11.72	11.40	11.40	11.40	11.50	11.47
25					14.50	20.95	11.70	11.47	11.40	11.45	11.50	11.47
26					14.55	18.70	11.70	11.47	11.40	11.45	11.47	11.47
27					14.20	17.10	11.70	11.47	11.40	11.50	11.45	11.45
28					13.60	15.70	11.65	11.47	11.40	11.50	11.42	11.42
29					13.20	14.90	11.70	11.50	11.40	11.50	11.45	11.40
30					13.20	14.35	11.70	11.50	11.40	11.50	11.50	11.40
31					13.10		11.70	11.50		11.45		11.40

No discharge from August 17 to 24, September 3 to 10, and September 21 to October 24, (a) Gauge reading at 10 p. m. was 21.35.

1365G 1893.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m.; elevation of zero, 587.04; gauge reader, William Kirkham; copied by R. L. Hauser from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.40	11.47	16.10	13.20	15.60	12.00	12.10	11.50	11.20	11.35	11.27	11.30
2	11.40	11.47	16.25	12.80	15.85	12.00	12.00	11.45	11.20	11.35	11.30	11.30
3	11.40	11.47	17.65	12.60	15.40	12.30	11.95	11.45	11.20	11.95	11.50	11.30
4	11.40	11.47	18.80	12.45	14.70	12.80	11.90	11.42	11.20	11.70	11.35	11.30
5	11.40	11.50	17.45	12.40	14.20	13.85	11.82	11.40	11.20	11.57	11.35	11.40
6	11.40	11.50	16.10	12.35	14.20	13.15	11.80	11.37	11.20	11.50	11.30	11.40
7	11.40	11.55	15.50	12.20	14.10	12.80	11.75	11.35	11.20	11.50	11.30	11.40
8	11.40	11.55	15.60	12.10	13.80	12.52	11.80	11.32	11.20	11.50	11.30	11.40
9	11.40	11.55	18.50	12.12	13.40	12.40	11.90	11.30	11.20	11.50	11.35	11.30
10	11.40	11.55	18.40	12.10	13.10	12.50	12.15	11.22	11.20	11.60	11.50	11.30
11	11.42	11.55	18.20	12.10	12.80	15.25	12.15	11.20	11.20	11.50	11.40	11.30
12	11.45	11.60	18.20	12.15	12.77	15.90	12.00	11.20	11.20	11.45	11.35	11.30
13	11.45	11.65	17.60	12.50	13.10	15.10	11.95	11.20	11.20	11.45	11.30	11.35
14	11.47	11.70	16.60	12.75	13.00	14.20	11.92	11.20	11.20	11.45	11.30	11.48
15	11.47	12.10	15.80	12.55	13.02	13.70	11.87	11.20	11.20	11.45	11.40	11.50
16	11.50	13.10	14.60	12.40	13.12	13.32	11.85	11.25	11.20	11.45	11.30	11.60
17	11.50	13.40	14.10	12.32	13.25	13.10	11.80	11.30	11.20	11.35	11.30	12.05
18	11.50	13.60	13.85	12.30	13.20	12.80	11.80	11.32	11.17	11.32	11.30	12.20
19	11.50	12.90	13.60	12.35	13.10	12.55	11.75	11.32	11.17	11.40	11.30	12.70
20	11.50	12.50	13.32	13.60	12.85	12.50	11.72	11.30	11.17	11.40	11.30	12.40
21	11.50	12.25	13.22	16.40	12.65	13.90	11.70	11.30	11.17	11.40	11.30	12.20
22	11.50	12.20	13.45	16.60	12.52	15.60	11.65	11.27	11.30	11.27	11.30	12.00
23	11.50	12.10	14.45	16.17	12.35	14.75	11.60	11.27	11.35	11.27	11.30	11.95
24	11.50	12.00	15.30	15.70	12.35	13.90	11.60	11.25	11.35	11.27	11.30	12.15
25	11.47	11.85	15.60	15.35	12.35	13.30	11.57	11.22	11.35	11.27	11.30	12.82
26	11.47	11.90	15.30	14.90	12.30	13.00	11.57	11.22	11.30	11.27	11.30	13.10
27	11.45	11.80	14.90	15.75	12.20	12.80	11.57	11.25	11.30	11.27	11.35	12.95
28	11.40	13.90	14.70	15.50	12.20	12.60	11.55	11.30	11.35	11.30	11.30	12.65
29	11.40	.....	14.30	14.90	12.15	12.40	11.52	11.27	11.35	11.27	11.30	12.60
30	11.40	.....	14.00	14.70	12.10	12.25	11.52	11.25	11.40	11.32	11.30	12.40
31	11.47	.....	13.60	.....	12.00	.....	11.52	11.20	.....	11.35	.....	12.65

No discharge from January 1 to 10 and 27 to 30, August 5 to October 2, October 20 to November 2, November 5 to 9 and 12 to 14, and November 30 to December 11.

1365H Gauge readings, Illinois and Des Plaines rivers, Illinois—Continued.

Riverside, Ill.—Continued.

1894.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m. (read at 6:15 a. m. from Apr. 1 to July 7, and from Sept. 9 to Nov. 10); elevation of zero, 587.04; the zero of the gauge was at elevation 587.04 until Feb. 15, and was then changed to 587.00. Gauge reader, William Kirkham; copied by R. L. Hauser from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	12.40	12.35	13.10	11.85	12.70	12.12	11.60	11.20	10.85	11.25	11.30	11.50
2	12.17	12.30	14.60	13.20	13.77	12.00	11.60	11.20	10.85	11.30	11.35	11.35
3	12.10	12.30	15.20	13.00	13.90	11.95	11.57	11.20	10.85	11.35	11.40	11.30
4	12.07	12.20	15.60	12.87	13.87	11.80	11.55	11.20	11.30	11.35	11.40	11.43
5	12.05	12.10	16.60	12.70	14.45	11.85	11.55	11.20	11.40	11.35	11.40	11.45
6	11.90	12.15	18.30	12.55	15.52	11.80	11.53	11.20	11.35	11.35	11.40	11.45
7	11.90	12.02	18.77	12.40	16.35	11.70	11.53	11.17	11.45	11.30	11.45	11.43
8	11.87	11.97	18.45	12.30	16.30	11.70	11.50	11.17	11.50	11.25	11.45	11.37
9	11.80	12.20	17.72	12.25	15.52	11.70	11.50	11.15	12.25	11.20	11.50	11.30
10	11.80	14.60	17.00	12.35	14.90	11.70	11.47	11.15	12.10	11.20	11.50	11.27
11	11.75	15.60	16.10	14.45	14.52	11.67	11.47	11.15	12.20	11.20	11.50	11.30
12	11.90	15.20	15.10	14.60	14.12	11.62	11.45	11.15	12.10	11.15	11.40	11.35
13	11.70	14.82	14.45	14.05	13.52	11.60	11.43	11.15	12.00	11.17	11.50	11.35
14	11.65	14.50	13.95	13.60	13.17	11.60	11.43	11.15	11.70	11.20	11.50	11.45
15	11.62	13.70	13.60	13.35	12.70	11.60	11.40	11.13	11.60	11.20	11.55	11.50
16	11.65	13.22	13.50	13.17	12.85	11.57	11.40	11.13	11.50	11.20	11.55	11.60
17	11.67	13.20	13.30	12.95	12.85	11.53	11.40	11.13	11.70	11.25	11.53	11.70
18	11.70	12.90	13.00	12.72	12.67	11.65	11.37	11.10	11.70	11.25	11.53	11.65
19	11.65	13.00	12.95	12.90	14.25	11.65	11.37	11.10	11.70	11.30	11.50	11.70
20	11.70	13.22	12.85	12.90	14.97	11.60	11.35	11.10	11.65	11.27	11.55	11.67
21	13.90	13.22	12.82	12.80	15.15	11.65	11.35	11.07	11.57	11.35	11.50	11.47
22	14.45	13.22	12.90	12.47	14.45	11.65	11.35	11.07	11.50	11.40	11.50	11.60
23	13.50	13.17	12.85	12.40	13.80	11.60	11.35	11.05	11.45	11.35	11.50	11.67
24	13.40	12.95	12.75	12.30	13.35	11.60	11.33	11.03	11.40	11.30	11.53	11.62
25	12.90	12.80	12.55	12.25	13.07	11.57	11.33	11.00	11.37	11.30	11.50	11.62
26	12.70	12.70	12.25	12.10	12.77	11.60	11.30	10.97	11.35	11.27	11.50	11.50
27	12.80	12.60	11.97	12.05	12.50	11.60	11.30	10.95	11.35	11.25	11.47	11.47
28	12.80	13.10	11.85	12.00	12.40	11.60	11.27	10.95	11.35	11.25	11.55	(a)
29	12.70	.....	12.05	12.10	12.35	11.60	11.27	10.92	11.35	11.25	11.50	(a)
30	12.55	.....	12.10	12.37	12.20	11.60	11.27	10.90	11.30	11.27	11.55	(a)
31	12.45	.....	12.00	.....	12.12	.....	11.25	10.87	.....	11.27	.....	(a)

a Gauge reader sick from Dec. 28, 1894, to Jan. 7, 1895, inclusive.

No discharge from March 14 to September 6, and from September 23 to November 1.

1365I 1895.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m. (taken between 6 and 7 a. m. from Nov. 1 to Dec. 31); elevation of zero, 587.00; gauge reader, William Kirkham; copied by R. L. Hauser from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)	10.90	15.15	11.85	11.60	11.48	11.10	11.17	11.82	11.32	11.30	11.45
2	(a)	11.30	14.70	12.08	11.55	11.48	11.10	11.17	11.80	11.28	11.30	11.45
3	(a)	11.25	13.70	12.18	11.50	11.45	11.10	11.17	11.60	11.25	11.30	11.45
4	(a)	11.20	14.70	12.18	11.50	11.42	11.10	11.17	11.50	11.25	11.30	11.42
5	(a)	11.20	13.90	12.18	11.55	11.40	11.10	11.17	11.50	11.00	11.25	11.42
6	(a)	11.20	13.00	12.10	11.70	11.38	11.10	11.15	11.42	11.22	11.25	11.40
7	(a)	11.17	12.70	12.00	11.85	11.40	11.10	11.15	11.38	11.28	11.25	11.40
8	11.30	11.17	12.50	12.30	11.80	11.38	11.10	11.12	11.35	11.35	11.30	11.40
9	11.30	11.17	12.50	12.80	11.85	11.35	11.07	11.10	11.30	11.35	11.38	11.40
10	11.27	11.17	12.50	13.45	11.90	11.35	11.07	11.10	11.90	11.35	11.45	11.40
11	11.25	11.17	12.80	13.15	12.00	11.35	11.07	11.10	12.05	11.35	11.50	11.38
12	11.45	11.40	12.60	12.85	12.35	11.35	11.05	11.10	12.20	11.32	11.50	11.38
13	11.33	11.40	12.60	12.60	12.28	11.35	11.05	11.10	12.12	11.32	11.45	11.35
14	11.27	11.40	12.25	12.40	12.12	11.35	11.02	11.10	11.92	11.35	11.40	11.35
15	11.25	11.50	12.25	12.25	12.10	11.35	11.02	11.10	11.80	11.38	11.40	11.35
16	11.23	11.45	12.20	12.18	11.95	11.35	11.00	11.10	11.75	11.38	11.40	11.35
17	11.20	11.40	12.20	12.10	11.90	11.35	11.00	11.10	11.60	11.35	11.40	11.40
18	11.13	11.37	12.00	12.00	11.80	11.32	10.97	11.12	11.52	11.35	11.40	11.90
19	11.15	11.33	12.00	11.90	11.78	11.30	11.07	11.00	11.50	11.32	11.40	13.20
20	11.30	11.27	11.90	11.85	11.72	11.25	11.10	11.00	11.45	11.30	11.40	17.00
21	11.40	11.27	12.10	11.80	11.70	11.22	11.10	10.97	11.38	11.30	11.40	18.40
22	11.27	11.27	12.15	11.72	11.68	11.20	11.10	10.92	11.35	11.30	11.40	17.80
23	11.20	11.27	12.15	11.62	11.65	11.20	11.10	10.90	11.32	11.30	11.40	16.90
24	11.15	11.35	12.10	11.60	11.68	11.20	11.10	11.37	11.40	11.30	11.42	15.70
25	11.05	11.45	12.05	11.60	11.62	11.20	11.10	11.47	11.40	11.30	11.42	15.40
26	11.00	12.87	11.97	11.65	11.60	11.20	11.10	11.40	11.45	11.30	11.45	15.15
27	11.00	14.00	12.00	11.52	11.55	11.17	11.10	11.45	11.35	11.30	11.45	14.40
28	11.00	15.35	11.90	11.55	11.55	11.15	11.10	11.40	11.35	11.30	11.45	13.90
29	11.00	.....	11.88	11.60	11.55	11.15	11.10	11.65	11.35	11.30	11.45	13.50
30	10.95	.....	11.85	11.60	11.50	11.12	11.12	11.62	11.35	11.30	11.45	13.10
31	10.95	.....	11.85	.....	11.50	.....	11.12	11.82	.....	11.30	.....	12.60

a Gauge reader sick from Dec. 28, 1894, to Jan. 7, 1895, inclusive.

No discharge from January 8 to February 25, June 4 to August 24, September 21 to November 10, November 14 to 26, and December 4 to 17.

1365J Gauge readings, Illinois and Des Plaines rivers, Illinois—Continued.

Riverside, Ill.—Continued.

1896.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 6:15 a. m.; elevation of zero, 587.00; gauge reader, William Kirkham; copied by R. L. Hauser, from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	12.50	12.15	14.95	13.95	12.30	12.80	11.40	12.18	11.30	12.75	11.45	12.55
2	12.60	12.15	14.10	13.68	12.25	12.40	11.38	12.13	11.30	13.00	11.45	12.25
3	12.70	12.20	13.50	13.30	12.25	12.25	11.38	12.08	11.30	13.00	11.55	12.20
4	12.78	12.20	13.15	13.10	12.25	12.15	11.35	11.95	11.28	13.00	11.75	11.95
5	12.78	12.15	12.90	12.70	12.20	12.03	11.35	11.85	11.28	12.90	12.00	11.85
6	12.60	12.00	12.83	12.60	12.10	11.90	11.35	11.80	11.28	12.75	12.15	11.80
7	12.40	11.95	13.50	12.53	11.98	11.80	11.35	11.70	11.28	12.63	12.10	11.80
8	12.15	11.90	13.70	12.45	11.85	11.80	11.33	11.63	11.28	12.55	12.08	11.80
9	12.00	11.90	13.68	12.28	11.80	11.70	11.33	11.55	11.28	12.45	12.05	11.90
10	12.00	11.90	13.50	12.20	11.75	11.73	11.30	11.50	11.28	12.40	12.18	11.90
11	11.85	11.90	13.40	12.20	11.70	11.50	11.30	11.50	11.28	12.35	12.40	11.90
12	12.00	11.90	13.15	12.30	11.70	11.50	11.30	11.55	11.28	12.30	13.00	12.00
13	11.85	11.90	12.70	12.40	11.68	11.60	11.30	11.60	11.30	12.25	13.30	12.10
14	11.75	11.90	12.65	12.60	11.65	11.60	11.30	11.65	11.35	12.20	13.20	12.10
15	11.68	11.90	12.43	12.90	11.63	11.55	11.30	11.70	12.48	12.10	12.90	12.10
16	11.63	11.90	12.35	12.93	11.58	11.60	11.30	11.63	12.50	12.00	12.70	12.10
17	11.58	11.90	12.35	12.80	11.53	11.63	11.30	11.58	12.78	11.90	12.60	12.10
18	11.53	11.90	12.43	12.60	11.50	11.50	11.30	11.53	12.70	11.85	12.60	12.10
19	11.50	11.85	12.55	12.40	11.48	11.40	11.30	11.50	12.68	11.80	12.57	12.05
20	11.50	11.83	12.85	12.30	11.45	11.35	11.30	11.50	12.65	11.75	12.55	12.00
21	11.50	11.83	12.75	12.90	11.50	11.40	11.30	11.50	12.65	11.75	12.55	12.35
22	11.50	11.85	12.85	13.30	11.50	11.40	11.30	11.50	12.70	11.78	12.53	12.10
23	11.55	11.95	12.90	13.00	11.60	11.40	11.30	11.50	12.70	11.75	12.50	11.85
24	11.85	12.50	12.90	13.65	11.60	11.40	11.40	11.48	12.70	11.65	12.45	11.60
25	12.00	13.90	12.83	13.65	12.00	11.40	11.40	11.45	12.70	11.55	12.45	11.55
26	12.10	16.28	12.85	13.10	13.60	11.40	11.45	11.45	12.60	11.50	12.48	11.50
27	12.10	16.58	12.70	12.90	14.50	11.40	11.55	11.43	12.53	11.50	12.75	11.50
28	12.13	17.10	12.70	12.73	13.78	11.40	11.70	11.38	12.50	11.48	12.83	11.50
29	12.13	16.60	13.38	12.60	13.30	11.40	11.78	11.33	12.50	11.48	12.40	11.70
30	12.15	.....	14.60	12.43	12.90	11.40	11.90	11.30	12.60	11.45	12.70	11.70
31	12.15	.....	14.45	.....	13.08	.....	12.05	11.30	.....	11.45	.....	11.70

No discharge from June 19 to July 26, and from August 26 to September 14.

1365K 1897.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m.; elevation of zero, 587.04; gauge reader, William Kirkham; copied by R. L. Hauser from weekly gauge reports filed in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.95	13.05	12.70	16.52	15.05	11.70	11.90	11.50	11.32	11.18	11.15	11.50
2	12.50	12.95	12.65	15.82	14.42	11.68	11.90	11.50	11.30	11.18	11.20	11.50
3	16.10	12.82	12.55	15.48	14.05	11.62	11.90	11.45	11.30	11.18	11.20	11.50
4	19.15	12.80	12.25	15.15	13.82	11.62	11.90	11.45	11.30	11.18	11.20	11.50
5	18.40	12.80	12.15	14.80	13.65	11.65	11.90	11.44	11.30	11.18	11.20	11.50
6	17.70	12.80	12.40	14.42	13.40	11.55	11.88	11.42	11.30	11.18	11.20	11.50
7	19.60	12.85	12.60	14.18	13.10	11.55	11.82	11.40	11.30	11.15	11.20	11.50
8	19.40	12.92	12.90	13.90	12.80	11.52	11.80	11.40	11.30	11.15	11.20	11.50
9	18.70	13.00	13.70	13.60	12.60	11.55	11.70	11.40	11.30	11.12	11.25	11.50
10	17.60	12.90	15.10	13.38	12.40	11.60	11.68	11.40	11.30	11.12	11.28	11.50
11	16.55	12.85	15.55	13.15	12.30	11.60	11.60	11.40	11.30	11.12	11.30	11.50
12	15.30	12.85	16.20	13.00	12.20	11.55	11.60	11.40	11.30	11.10	11.30	11.50
13	14.30	12.75	15.75	12.82	12.05	11.50	11.60	11.40	11.30	11.10	11.40	11.50
14	14.45	12.95	16.10	12.82	12.00	11.50	11.60	11.40	11.28	11.10	11.45	11.50
15	14.45	13.10	15.30	12.87	12.00	11.50	11.60	11.40	11.28	11.08	11.50	11.50
16	14.10	13.30	14.90	12.82	12.00	11.50	11.60	11.40	11.28	11.08	11.55	11.50
17	.....	13.50	14.80	13.00	12.00	11.70	11.60	11.40	11.25	11.08	11.55	11.50
18	16.40	13.80	14.75	13.05	11.92	12.90	11.60	11.40	11.25	11.08	11.50	11.50
19	16.88	14.00	14.85	12.90	11.90	13.30	11.58	11.40	11.25	11.05	11.50	11.48
20	16.25	14.12	16.82	12.70	11.85	13.15	11.58	11.38	11.25	11.05	11.50	11.48
21	16.45	15.00	18.65	12.55	11.80	13.00	11.55	11.38	11.22	11.10	11.55	11.45
22	15.10	15.37	18.97	12.50	11.82	12.70	11.55	11.35	11.22	11.10	11.68	11.42
23	14.60	15.30	18.80	12.70	11.82	12.50	11.52	11.35	11.22	11.10	11.60	11.40
24	14.65	14.95	18.20	13.60	11.90	12.48	11.52	11.35	11.22	11.10	11.55	11.35
25	14.47	14.60	17.10	14.60	11.85	12.35	11.50	11.35	11.22	11.10	11.50	11.28
26	14.40	14.00	16.25	15.30	11.85	12.32	11.55	11.35	11.22	11.10	11.50	11.25
27	14.37	14.35	15.80	14.68	11.80	12.28	11.55	11.32	11.22	11.10	11.50	11.25
28	14.20	13.60	15.70	14.05	11.80	12.20	11.50	11.32	11.22	11.15	11.50	11.30
29	13.87	.....	16.00	13.70	11.75	12.05	11.48	11.32	11.20	11.15	11.50	11.30
30	13.52	.....	16.67	15.00	11.70	11.90	11.45	11.32	11.20	11.15	11.50	11.30
31	13.25	.....	16.97	.....	11.70	.....	11.45	11.32	.....	11.15	.....	11.30

5696

1365L Gauge readings. Illinois and Des Plaines rivers, Illinois—Continued.

Riverside, Ill.—Continued.

1898.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m.; elevation of zero, 587.00; gauge reading by William Kirkham from Jan. 1 to Nov. 27, and by P. A. Pope from Nov. 27 to Dec. 31; copied by R. L. Hauser from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.30	11.80	12.60	13.70	11.90	12.00	14.00	11.80	11.40	11.50	11.80	11.75
2	11.30	11.90	12.50	13.40	11.90	12.00	13.80	11.77	11.40	11.50	11.77	11.70
3	11.30	11.90	12.80	13.25	11.90	12.00	13.30	11.72	11.40	11.50	11.72	11.70
4	11.30	11.90	12.40	13.10	11.90	11.95	12.80	11.67	11.40	11.50	11.70	11.70
5	11.30	11.90	12.70	12.80	11.90	11.90	12.50	11.62	11.40	11.50	11.80	11.67
6	11.30	11.85	12.85	12.60	11.90	11.90	12.30	11.55	11.40	11.50	11.77	11.67
7	11.30	11.75	12.90	12.40	11.90	11.85	12.15	11.45	11.40	11.50	11.70	11.60
8	11.30	11.75	13.90	12.30	11.90	11.80	12.10	11.45	11.40	11.50	11.75	11.60
9	11.30	11.85	15.60	12.35	11.87	11.80	12.00	11.42	11.40	11.50	11.80	11.50
10	11.30	12.00	16.57	12.50	11.85	11.80	11.95	11.42	11.40	11.50	12.00	11.50
11	11.35	14.01	18.20	12.80	11.85	11.90	11.90	11.40	11.40	11.52	13.55	11.50
12	11.52	16.90	19.60	12.65	11.82	11.95	11.87	11.40	11.40	11.55	13.65	11.50
13	11.67	17.00	19.70	12.60	11.82	12.00	11.80	11.40	11.40	11.55	13.20	11.40
14	11.80	16.60	19.10	12.30	11.80	12.10	11.77	11.40	11.45	11.55	13.20	11.35
15	11.90	15.60	18.17	12.25	11.80	12.20	11.72	11.50	11.50	11.57	12.77	11.35
16	11.90	14.95	17.30	12.15	11.77	12.30	11.70	11.62	11.60	11.57	12.60	11.30
17	11.90	14.35	16.50	12.05	11.80	12.25	11.60	11.67	11.60	11.60	12.50	11.30
18	11.70	14.10	15.60	12.10	11.85	12.20	11.57	11.72	11.60	11.60	12.70	11.30
19	11.70	14.60	17.20	12.10	11.85	12.15	11.55	11.80	11.55	11.62	12.67	11.40
20	11.80	14.80	18.72	12.10	11.90	12.15	11.55	11.75	11.50	11.65	12.57	11.80
21	12.40	14.90	17.92	12.10	12.30	12.15	11.52	11.70	11.50	11.65	12.50	12.50
22	12.70	14.70	16.90	12.10	12.40	12.10	11.52	11.60	11.50	11.67	12.30	12.85
23	13.00	14.40	16.10	12.10	12.35	12.00	11.50	11.52	11.50	11.67	12.10	12.60
24	12.70	14.00	15.55	12.10	12.25	12.00	11.50	11.50	11.50	11.70	12.05	12.50
25	12.50	13.90	14.90	12.05	12.20	12.70	11.50	11.45	11.50	11.75	12.05	12.40
26	12.20	13.50	14.35	12.00	12.15	16.90	11.50	11.42	11.50	11.80	12.00	12.35
27	12.00	13.00	14.80	11.95	12.10	17.60	11.50	11.42	11.50	11.90	11.90	12.05
28	11.92	12.80	16.70	11.95	12.05	17.35	11.50	11.40	11.50	11.95	11.80	12.00
29	11.90	.....	16.30	11.90	12.05	16.27	11.60	11.40	11.50	11.95	11.80	11.90
30	11.82	.....	15.50	11.90	12.00	15.25	11.75	11.40	11.50	11.87	11.75	11.75
31	11.75	.....	14.20	.....	12.00	.....	11.80	11.40	.....	11.80	.....	11.70

No discharge from January 1 to 11, August 10 to 14, August 27 to September 13, and from December 12 to 19.

1365M 1899.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m.; elevation of zero, 587.00; gauge reader, P. A. Pope, from January 1 to February 25, F. C. Hornold February 25 to March 18, and Hans Isak from March 19 to December 31; copied by R. L. Hauser from records in the office of Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.65	11.40	16.07	13.33	11.80	17.25	11.43	11.50	11.40	11.50	11.50	11.40
2	11.60	11.40	15.60	12.40	11.80	17.00	11.43	11.45	11.38	11.50	11.50	11.40
3	11.50	11.40	15.45	13.03	11.80	15.70	11.40	11.43	11.38	11.50	11.50	11.40
4	11.50	11.40	15.45	12.78	11.77	14.70	11.40	11.40	11.35	11.48	11.50	11.40
5	11.60	11.40	15.40	12.78	11.75	13.75	11.45	11.60	11.35	11.45	11.50	11.40
6	11.70	11.37	14.90	12.60	11.75	13.00	11.60	11.60	11.35	11.43	11.50	11.40
7	11.95	11.37	14.40	12.55	11.75	13.15	12.00	11.48	11.35	11.40	11.50	11.40
8	11.80	11.35	14.00	12.50	12.10	13.00	12.55	11.45	11.35	11.40	11.48	11.40
9	11.70	11.32	13.85	12.50	12.20	12.80	12.55	11.38	11.35	11.40	11.45	11.40
10	11.60	11.30	13.70	12.40	12.20	12.55	12.55	11.33	11.35	11.38	11.45	11.35
11	11.60	11.30	13.60	12.40	11 18	12.30	12.55	11.30	11.35	11.35	11.40	11.35
12	11.60	11.28	13.05	12.40	12.05	12.15	12.55	11.40	11.70	11.35	11.40	11.40
13	11.60	11.25	12.90	12.40	12.13	12.05	12.55	11.60	11.65	11.35	11.40	11.60
14	11.80	11.25	12.65	12.40	12.00	11.95	12.55	11.75	11.55	11.35	11.40	11.80
15	11.80	11.20	12.60	12.50	11.98	12.15	13.20	11.95	11.47	11.35	11.40	11.80
16	11.80	11.25	12.60	12.45	11.98	12.05	14.30	12.00	11.42	11.35	11.50	11.60
17	11.85	11.27	12.60	12.45	12.10	11.95	13.80	11.98	11.38	11.35	11.60	11.60
18	11.97	11.30	14.40	12.25	12.90	11.85	13.45	11.90	11.45	11.35	11.70	11.65
19	12.00	11.30	15.83	12.20	13.65	11.80	13.15	11.70	11.55	11.35	11.75	11.70
20	11.75	11.40	15.90	12.10	13.15	11.70	12.75	11.65	11.48	11.35	11.70	11.70
21	11.70	11.40	14.63	12.05	12.65	11.65	12.40	11.65	11.45	11.35	11.60	11.80
22	11.75	11.50	13.78	12.05	12.55	11.63	12.30	11.63	11.50	11.40	11.50	12.80
23	11.80	11.50	12.70	11.90	12.43	11.60	12.15	11.60	11.55	11.40	11.40	12.90
24	11.80	11.90	12.70	11.80	12.10	11.60	12.00	11.58	11.50	11.45	11.40	12.80
25	11.80	12.60	12.83	11.80	11.95	11.58	11.95	11.55	11.53	11.45	11.40	12.60
26	11.90	15.10	13.93	11.80	11.93	11.55	11.90	11.53	11.55	11.48	11.40	12.40
27	11.70	16.40	14.83	11.78	11.88	11.55	11.85	11.50	11.55	11.48	11.40	12.20
28	11.50	16.50	14.80	11.75	12.50	11.53	11.78	11.48	11.55	11.50	11.40	12.00
29	11.50	.....	14.03	11.75	13.90	11.48	11.73	11.45	11.55	11.50	11.40	11.80
30	11.45	.....	13.60	11.90	15.40	11.45	11.70	11.43	11.50	11.50	11.40	11.60
31	11.40	.....	12.70	.....	15.90	.....	11.65	11.43	.....	11.50	.....	11.60

No discharge from January 30 to February 21, July 1 to 4, August 2 to 4, August 8 to 12, August 30 to September 11, October 11 to 23, November 10 to 15, and November 27 to December 12.

1365N Gauge readings, Illinois and Des Plaines Rivers, Illinois.—Continued.

Riverside, Ill.—Continued.

1900.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 7 a. m.; elevation of zero, 587.00; gauge reader, Hans Isak; copied by R. L. Hauser from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.60	12.00	12.40	13.90	11.80	11.40	11.40	11.63	13.88	11.60	11.85	12.50
2	11.60	11.90	12.40	13.90	11.80	11.40	11.38	11.60	13.60	11.60	11.90	12.35
3	11.60	11.70	12.40	13.98	11.78	11.40	11.35	11.58	13.40	11.60	11.90	12.30
4	11.60	11.60	12.30	13.90	11.73	11.40	11.35	11.55	13.20	11.60	11.90	12.20
5	11.60	11.90	12.25	13.70	11.70	11.40	11.35	11.55	13.00	11.60	11.90	12.15
6	11.60	13.20	12.10	13.40	11.70	11.60	11.35	11.55	12.80	11.60	11.90	12.15
7	11.60	14.20	12.40	13.20	11.70	12.00	11.35	11.55	12.65	11.60	11.90	12.10
8	11.65	14.80	12.50	12.90	12.00	12.40	11.45	11.55	12.55	11.60	11.90	12.10
9	11.70	15.30	12.55	12.70	12.60	12.10	11.48	11.55	12.45	11.60	11.90	12.10
10	11.75	15.55	12.60	12.50	12.25	12.10	11.50	11.55	12.35	11.60	11.90	12.10
11	11.75	15.30	15.00	12.30	12.00	11.90	11.50	11.53	12.25	11.60	11.90	12.00
12	11.75	14.90	16.10	12.20	12.00	11.70	11.48	11.53	12.15	11.60	11.90	12.00
13	11.75	14.45	17.40	12.20	11.90	11.60	11.45	11.55	12.13	11.60	11.90	11.90
14	11.75	13.90	17.50	12.20	11.85	11.55	11.43	11.65	12.08	11.60	11.88	11.90
15	11.75	13.40	17.10	12.20	11.75	11.55	11.43	11.60	12.03	11.60	11.83	11.90
16	11.75	12.95	16.00	12.20	11.65	11.53	11.40	11.70	11.98	11.60	11.78	11.90
17	11.80	12.65	15.40	12.30	11.60	11.50	11.50	11.73	11.93	11.60	11.73	11.90
18	12.00	12.50	15.20	12.60	11.50	11.50	11.50	11.78	11.88	11.60	11.70	11.90
19	12.30	12.40	14.80	13.60	11.50	11.48	11.50	11.90	11.83	11.60	11.80	11.87
20	12.50	12.40	14.40	13.25	11.55	11.45	11.50	12.00	11.80	11.60	12.10	11.85
21	13.00	12.40	14.80	13.00	11.55	11.45	11.50	11.98	11.78	11.60	12.50	11.80
22	12.90	12.40	14.40	12.80	11.55	11.45	11.55	11.93	11.75	11.60	12.80	11.80
23	12.70	12.40	13.00	12.55	11.53	11.45	11.53	11.95	11.70	11.60	12.80	11.80
24	12.50	12.40	13.40	12.40	11.53	11.45	11.53	12.10	11.70	11.60	12.60	11.80
25	12.50	12.40	15.30	12.35	11.48	11.43	11.63	12.20	11.70	11.60	12.50	11.80
26	12.40	12.40	15.70	12.25	11.45	11.43	11.80	13.15	11.70	11.60	12.58	11.80
27	12.40	12.40	15.70	12.15	11.43	11.40	11.75	13.83	11.68	11.60	12.60	11.80
28	12.40	12.40	15.90	12.00	11.40	11.40	11.75	14.53	11.65	11.65	12.70	11.80
29	12.30	.....	15.50	11.90	11.45	11.40	11.68	14.48	11.65	11.70	12.70	11.80
30	12.20	.....	14.40	11.83	11.45	11.40	11.65	14.05	11.63	11.75	12.68	11.70
31	12.10	.....	13.90	.....	11.43	.....	11.65	13.93	.....	11.80	.....	11.70

No discharge May 31 to June 6, June 25 to July 7, and July 14 to July 16.

13650 1901.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 6 a. m.; elevation of zero, 587.04; gauge reader, Hans Isak; copied by Henry Fox from weekly gauge reports filed in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.7	11.7	11.6	14.8	11.6⅜	11.9	11.9	11.9	11.9	11.9	11.9	11.4
2	11.7	11.7	11.6	14.5¼	11.6¼	11.9	11.9	11.9	11.9	11.9	11.9	11.4
3	11.7	11.7	11.6	14.2⅜	11.6¼	11.9	12.2	11.9	11.9	11.9	11.9	11.4
4	11.7	11.7	11.8	14.0	11.6	11.9	12.0	11.9	11.9	11.9	11.9	11.4
5	11.7	11.7	11.9	13.6¼	11.5¼	11.9	11.9	11.9	11.9	11.9	11.9	11.4
6	11.7	11.7	12.2	13.4⅛	11.5¼	12.0	11.9	11.9	11.9	11.9	11.9	11.4
7	11.6⅜	11.7	12.5	13.3	11.5	12.0	11.9	11.9	11.9	11.9	11.9	11.4
8	11.6¼	11.7	12.7	13.2⅛	11.5	11.9	11.9	11.9	11.9	11.9	11.9	11.4
9	11.6⅛	11.7	12.9	13.1⅛	11.5⅛	11.9	11.9	11.9	11.9	11.9	11.9	11.4
10	11.6	11.7	13.6	12.8	11.5⅛	11.9	11.9	11.9	11.9	11.9	11.9	11.4
11	11.5⅜	11.6	16.8	12.6⅛	11.5	11.9	11.9	11.9	11.9	11.9	11.9	11.4
12	11.5⅛	11.6	17.8⅛	12.5⅛	11.5	11.9	11.9	11.9	11.9	11.9	11.8⅜	11.4
13	11.6	11.6	18.3⅛	12.4⅛	11.5	11.9	11.9	11.9	11.9	11.9	11.8⅛	11.4
14	11.7	11.6	18.2⅛	12.3⅛	11.5	11.9	11.9	11.9	11.9	11.9	11.8¼	11.4
15	11.8	11.6	18.0	12.2⅜	11.5	11.9	11.9	11.9	11.9	11.9	11.8	11.4
16	11.9	11.6	17.8	12.2¼	11.5	11.9	11.9	11.9	11.9	11.9	11.7⅞	11.4
17	11.8⅛	11.6	17.4	12.1⅜	11.5	11.9	11.9	11.9	11.9	11.9	11.7¼	11.4
18	11.8⅛	11.6	17.0⅛	12.1¼	11.5	11.9	11.9	11.9	11.9	11.9	11.7	11.4
19	11.8	11.6	17.5	12.1⅛	11.5⅛	11.9	11.9	11.9	11.9	11.9	11.6⅜	11.4
20	11.8	11.6	18.2	12.0⅜	11.6⅛	11.9	11.9	11.9	11.9	11.9	11.6⅛	11.4
21	11.8⅛	11.6	18.4	12.0	11.7⅛	11.9	11.9	11.9	11.9	11.9	11.6¼	11.4
22	11.9⅛	11.6	17.6	11.9⅛	11.8⅛	11.9	11.9	11.9	11.9	11.9	11.6	11.4
23	11.9⅛	11.6	17.1	11.9	11.9⅛	11.9	11.9	11.9	11.9	11.9	11.6	11.4
24	11.9	11.6	17.0	11.8⅜	12.0	11.9	11.9	11.9	11.9	11.9	11.6	11.4
25	11.8⅛	11.6	17.2	11.8⅛	12.0	11.9	11.9	11.9	11.9	11.9	11.6	11.4
26	11.7⅛	11.6	17.7⅛	11.8¼	11.9	11.9	11.9	11.9	11.9	11.9	11.5⅛	11.4
27	11.7	11.6	17.7⅛	11.8	11.9	11.9	11.9	11.9	11.9	11.9	11.5⅛	11.4
28	11.7	11.6	17.2⅛	11.8	11.9	11.9	11.9	11.9	11.9	11.9	11.4	11.4
29	11.7	.....	16.5⅛	11.7⅜	11.9	11.9	11.9	11.9	11.9	11.9	11.4	11.4
30	11.7	.....	15.7⅛	11.7¼	11.9	11.9	11.9	11.9	11.9	11.9	11.4	11.4
31	11.7	.....	15.0	.....	11.9	.....	11.9	11.9	.....	11.9	.....	11.4

1365P Gauge readings, Illinois and Des Plaines rivers, Illinois.—Continued.

Riverside, Ill.—Continued.

1902.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 6 a. m.; elevation of zero, 587.04; gauge reader, Hans Isak; copied by R. L. Hauser from weekly gauge reports filed at office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.4	11.4	12.2	12.5⅜	11.6	12.9	13.5	13.4½	11.5	14.8	12.3	12.1½
2	11.4	11.4	13.0	12.2½	11.5	13.2½	13.2	13.0	11.4⅜	14.8	12.2	12.3
3	11.4	11.4	12.8	12.0½	11.6½	14.5	12 8½	12.7	11.4⅜	14.5½	12.1½	12.8
4	11.4	11.4	12.6	11.8⅜	11.7	15.7	13.0½	12.4½	11.4½	14.2½	12.1	14.5
5	11.4	11.4	12.4	11.8½	11.7½	14.4	12.9⅜	12.4	11.4½	14.0½	12.2½	14.1
6	11.4	11.4	12.1	11.8	11.9	13.7	12.9½	12.3½	11.4	14.6	14.0	13.4
7	11.4	11.4	12.0	11.7⅜	12.0⅜	13.3½	12.7	12.3	11.4	14.5	15.2	12.8
8	11.4	11.4	12.0	11.7½	12.8	16.3	12.6	12.2	11.4	14.0	14.6½	12.7½
9	11.4	11.4	11.8½	11.7	12.5⅜	16.3	13.2½	12.1	11.4	13.5	14.2	12.6½
10	11.4	11.4	11.7½	11.6½	12.2½	15.6½	13.8	12.0	11.4	13.1½	13.9½	12.6
11	11.4	11.4	11.7	11.6	12.6	14.1½	13.7	11.9½	11.6	12.9	13.6	12.6½
12	11.4	11.4	11.7	11.5½	12.8	13.5½	13.4	11.9½	11.4	12.8	13.9⅜	12.7
13	11.4	11.4	12.8	11.5	12.7½	13.3½	13.2	11.9	11.4	12.8½	14.0	12.8½
14	11.4	11.4	13.8½	11.5	13.5	14.4½	13.1	11.8⅜	11.4	14.5½	13.8	13.0
15	11.4	11.4	13.0	11.5	13.4	14.5	13.0½	11.8½	11.4	15.5	13.8⅜	13.0½
16	11.4	11.4	12.6	11.4⅜	12.9½	14.0⅜	12.9½	11.8½	11.4	15.0	13.9	13.0½
17	11.4	11.4	12.3	11.4⅜	12.5½	13.4	12.9	11.8	11.4	14.6½	13.8	13.0½
18	11.4	11.4	12.0	11.4½	12.3½	12.8½	13.8	11.7⅜	11.4½	14.0	13.6	13.1½
19	11.4	11.4	12.2	11.4½	12.3½	12.5	16.8	11.7½	11.6	13.7	13.4	13.4
20	11.4	11.4	11.9½	11.4½	12.5	12.3	16.9	11.7	11.8	13.5½	13.3	13.6
21	11.4	11.4	11.9	11.4½	12.4⅜	12.2½	16.2	11.7	11.7½	13.3	13.2	13.7½
22	11.4	11.4	11.8½	11.4	12.5	12.1	15.3½	11.7	11.6	13.0	13.1	13.9
23	11.4	11.4	11.8	11.4	13.9½	12.0	14.5½	11.6½	11.6½	12.8	12.9	14.0
24	11.4	11.4	11.7½	11.3⅜	14.8	11.9½	14.1½	11.6½	11.7½	12.6½	12.7	14.5
25	11.4	11.4	11.7	11.3⅜	17.9	11.9	13.9	11.6½	11.9	12.5⅜	12.5	14.7
26	11.4	11.4	11.6½	11.8½	19.0	11.9	13.6⅜	11.6	12.2	13.2	12.3	14.4
27	11.4	11.4	11.6	11.9⅜	17.8½	11.9	13.6	11.5⅜	12.5	13.0	12.1	14.1½
28	11.4	11.8	11.6	12.0	16.9	11.9½	14.7	11.5½	12.6	12.8	11.9½	13.9
29	11.4	.....	11.6	11.8	14.5½	12.1	14.7	11.5½	13.4½	12.6	12.0	13.8
30	11.4	.....	11.8	11.7	14.7	13.1½	14.5	11.5	13.5	12.5	12.1	13.6½
31	11.4	.....	12.6	.....	13.1½	.....	13.8	11.5	.....	12.4	.....	13.5

1365Q 1903.

(Location of gauge; Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 8 a. m.; elevation of zero, 587.04; gauge reader, Hans Isak until February 28, Herbert Brooks from March 1; copied by Henry Fox from records in the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	13.4	12.9	16.7	13.3	12.1	11.9	11.5	12.0	13.2	12.6	11.9	11.5
2	13.2	12.7½	16.3	13.5	12.0½	11.8½	11.5	11.8	13.0	12.5	11.8½	11.5
3	13.0	12.6½	15.6	13.7	12.0	11.8	11.4½	11.8	12.9	12.5	11.8	11.5
4	12.9	12.6	14.8	13.3½	12.0	12.2	11.4½	11.9	12.8	12.6	11.8	11.5
5	12.8	12.5	14.3	13.3	11.9	12.2½	11.4½	12.1½	12.8	12.5½	11.8	11.4
6	12.6½	12.4½	14.2	13.1½	11.8½	12.2½	11.4	12.2½	12.7½	12.4	11.8	11.4
7	12.5	12.4	14.9	12.9	11.8½	12.1	11.4	12.2	12.6	12.4	11.7	11.4
8	12.3½	12.7½	18.5½	12.7	11.8½	12.1	11.4	12.1	12.5	12.6	11.7	11.4
9	12.2	13.2½	18.9	12.5	11.8	12.0½	11.4	12.0	12.4	12.8½	11.7	11.4
10	12.0½	13.7½	18.2	12.3½	11.8	11.9½	11.4½	11.9½	12.6	12.7	11.7	11.4
11	11.9	14.0	17.8	13.0	11.7	11.8½	12.1	11.8	13.1	12.5½	11.7	11.4
12	11.9	14.2½	17.3	14.9	11.7½	11.8	12.4	11.7½	13.3½	12.4	11.8	11.4
13	11.9	14.4½	16.5	15.4	11.7½	11.8	12.6	11.7	13.2	12.3	11.8	11.4
14	11.9	14.5½	15.8	15.8	11.7½	11.7½	12.5	11.7	13.1	12.3	11.8	11.3
15	11.9	14.6	15.5	16.4	11.7½	11.7	12.1	11.7	14.3	12.2½	11.7	(a)
16	11.9	14.5	15.0½	16.6	11.7	11.6½	11.9	11.7	16.0	12.3	11.7	(a)
17	11.9	14.4	14.8	16.3	11.6½	11.6	11.8	12.0	17.2	12.3	11.7	(a)
18	11.9	14.4	15.3	15.7	11.6½	11.6	12.0	12.7	16.8	12.2½	11.6½	(a)
19	11.9	14.4	15.6	15.0	11.6½	11.5	12.3	12.7	15.8	12.2	11.6	(a)
20	11.9	14.3½	16.9	14.4	11.6½	11.5	12.5	12.6	15.1	12.1½	11.6	(a)
21	11.9	14.3	19.2	14.0½	11.6	11.5	12.2½	12.5	14.6	12.1	11.6	11.3
22	11.9	14.2	19.1½	13.7	11.5½	11.5	12.1	12.4	14.3	12.1	11.6	11.3
23	11.9	13.9	18.0	13.3	11.5	11.9	12.0	12.3	14.0	12.1	11.6	11.4
24	11.9	13.5	17.3	13.0	11.6	11.8½	11.9	12.3	13.8	12.0	11.7	11.4
25	11.9	13.2	16.1	12.8	11.6	11.8	11.8	12.2½	13.5	11.9	11.8	11.4
26	12.0½	13.0	15.2	12.7	11.6	11.7	11.8	12.1½	13.2	11.9	11.9	11.4
27	12.3	14.8	14.8½	12.6	11.6	11.7	11.8	12.2	13.0½	11.9	11.5	11.5
28	12.4½	16.2	14.5	12.4	11.8	11.6	11.7	12.2	13.0	11.9	11.5	11.5
29	12.7	.....	14.1	12.2	12.1	11.5½	11.8	12.9	12.9	11.9	11.5	11.4
30	12.8½	.....	13.8	12.1½	12.0	11.5	12.0	13.2	12.7	11.9	11.5	(a)
31	12.9	.....	13.5	.....	12.0	.....	12.2	13.3½	.....	.....	.....	(a)

(a) Below gauge.

1365R Gauge readings, Illinois and Des Plaines rivers, Illinois.—Continued.

Riverside, Ill.—Continued.

1904.

(Location of gauge, Riverside, Ill.; in charge of Sanitary District of Chicago; time of day, 8 a. m.; elevation of zero, 587.04; gauge reader, Herbert Brooks; copied by R. L. Hauser from weekly reports filed at the office of the Sanitary District of Chicago, Ill.)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)	11.8	14.3	16.0	12.45	11.55	11.2	11.4	11.4	11.5	11.4	11.4
2	(a)	.....	14.3	15.7	12.3	11.50	11.2	11.4	11.4	11.45	11.4	11.4
3	11.4	.....	17.0	15.1	12.15	11.45	11.2	11.4	11.3	11.45	11.4	11.4
4	11.4	.....	16.4	14.6	12.05	11.45	11.2	11.3	11.3	11.5	11.4	11.4
5	11.4	11.5	16.0	14.2	12.0	11.45	11.2	11.3	11.2	11.5	11.45	11.4
6	11.4	12.1	15.9	13.95	11.9	11.45	11.2	11.3	11.2	11.5	11.5	11.4
7	11.4	15.9	16.6	13.75	12.0	11.45	11.2	11.3	11.3	11.4	11.5	11.4
8	11.4	15.9	17.6	13.65	12.0	11.40	11.3	11.2	11.3	11.4	11.5	11.4
9	11.4	14.8	18.4	14.2	12.1	11.40	11.3	11.2	11.2	11.4	11.5	11.4
10	11.4	14.4	18.7	14.45	12.25	11.40	11.2	11.2	(a)	11.4	11.5	11.4
11	11.4	14.2	18.6	14.2	12.35	11.35	11.2	11.2	(a)	11.4	11.5	11.4
12	11.4	13.9	18.3	14.0	12.20	11.35	11.2	11.2	11.2	11.5	11.5	11.4
13	11.4	13.4	17.9	13.8	12.1	11.3	11.2	11.2	11.2	11.5	11.5	11.4
14	11.4	13.0	17.5	13.55	12.1	11.3	11.4	11.45	11.2	11.5	11.5	11.4
15	11.4	12.8	16.8	13.3	12.0	11.3	11.5	11.4	11.3	11.45	11.5	11.4
16	11.4	12.7	15.9	13.1	11.9	11.3	11.4	11.45	11.2	11.5	11.5	11.35
17	11.4	12.5	15.3	12.9	11.9	11.9	11.3	11.4	11.2	11.45	11.5	11.35
18	11.4	12.4	15.3	12.8	11.9	11.3	11.3	11.3	11.4	11.45	11.5	11.35
19	11.4	12.4	14.8	12.6	11.9	11.3	11.25	11.2	11.3	11.45	11.5	11.35
20	11.6	12.3	15.9	12.5	11.9	11.3	11.25	11.4	11.4	11.45	11.5	11.35
21	12.0	12.3	17.9	12.35	11.85	11.3	11.2	11.6	11.4	11.45	11.5	11.4
22	12.9	12.2	20.7	12.25	11.8	11.25	11.2	12.1	11.5	11.4	11.5	11.4
23	13.0	12.2	21.3	12.2	11.8	11.25	11.2	12.5	11.4	11.4	11.5	11.4
24	12.9	12.1	20.5	13.1	11.75	11.25	11.2	12.0	11.35	11.4	11.5	11.4
25	12.7	12.1	21.1	14.0	11.7	11.2	11.2	11.8	11.4	11.45	11.5	11.4
26	12.5	12.0	21.0	14.4	11.7	11.2	11.2	11.7	11.4	11.45	11.45	11.45
27	12.1	12.0	19.5	14.0	11.7	11.2	11.2	11.6	11.4	11.45	11.4	11.45
28	12.0	12.0	18.1	13.35	11.65	11.2	11.2	11.5	11.55	11.45	11.4	11.5
29	11.9	13.6	17.1	12.9	11.6	11.2	11.2	11.5	11.5	11.45	11.4	11.6
30	11.8	.....	16.1	12.6	11.6	11.2	11.2	11.4	11.5	11.45	11.4	11.6
31	11.8	.....	15.8	.....	11.55	.....	11.4	11.3	.....	11.45	.....	11.55

(a) Below gauge.

1366 To summarize these columns, we would have an average precipitation of 31.09 inches; for the twenty years, the water stood at above 18 feet on the Riverside gauge for 87 days, or an average of 4.3 days per year. The water stood at or about 13.8 feet on the Riverside gauge during the twenty years for an aggregate of 952 days, or an average of 47.6

days per year. The water stood at or above 13 feet on the Riverside gauge during the 20 years for an aggregate of 1464 days, or an average of 73.2 days per year. At an elevation of 12.4 feet on the Riverside gauge, the water prevailed for an aggregate of 2,324 days, or an average of 116.2 days per year; and for an elevation at or above 11.85 feet on the Riverside gauge the water prevailed for 3,813 days, or an average of 190.65 days per year.

1367 The normal rainfall is given by the average for the 68 years of the record at Chicago, which is 33.99; the average deficiency during this period being 2.9 inches per year, or 58 inches for the period of 20 years. The highest known water occurred in the Desplaines river on April 21, 1881, and we referred to the Riverside gauge which was subsequently established and would establish on that gauge 21.6 feet, a volume of 13,500 second feet. Other high floods since that time are the flood of 1887 which culminated at Riverside on February 9, reaching an elevation of 20.22 feet and a volume of 10,324 feet. The flood of 1892 was also a characteristic flood, reaching an elevation of 20.95 feet and a volume of 12,100 second feet and culminated at Riverside on June 25.

1368 The three floods above mentioned have been determined by their height also at Joliet. I have the computation but I have not the elevations on the dams. The computations are as I made them in 1887.

Q. What are they?

(Objected to until the foundation has been laid by showing the elevations on the dams on which they were made.)

The computation was made from marks obtained upon the three dams then existing at Joliet, the co-efficients for those dams being verified by actual observation by myself. The quantities were computed by myself from that basis, while I was in the employ of the Drainage and Water Supply Commission; I computed two of them, the one of 1892 occurred while I was connected with the Sanitary District and the record was taken in connection with that flood profile of 1892, and the computations which I am about to state were made at the time of the floods; at the time of the computation I had the heights on the dam.

Q. Now you may give the volume of water at Joliet.

(Same objection.)

1369 A. The volume passing at Joliet when the flood of 1881 reached its height, which was on the same day as at Riverside, April 21, was computed at 6,550 second feet. The flood of 1887 culminated at Joliet on February 11, the volume reaching 5,775 second feet. The flood of 1892 culminated at Joliet on June 24, and reached a volume of 6,780 second feet.

The basin tributary to Joliet is about 173 square miles greater than the basin of the Desplaines tributary to the river at Riverside, or about 27 or 28 per cent. greater. The explanation as to why the flood volume at Riverside is so much greater than the flood volume at Joliet is from the fact that there is another outlet for the floods of the Desplaines river by which the major portion of the flood volume passing Riverside finds it way to Lake Michigan, said outlet being by way of Mud Lake region and the Chicago river. I have computed the volume which passed from the west fork of the Chicago river to Lake Michigan across Mud Lake during

1370 those floods. We have no direct measurement for the flood of 1881 in the Mud Lake region, but we can compute what the aggregate floods should be at Joliet and Kedzie avenue on the West Fork which ought to exceed that at Riverside by about 20 per cent. In other words, the aggregate floods at those two points should be 16,200 second fleet; the difference between that and the Joliet flood, 6,550 second feet, is 9,650 second feet, which is assumed to be the volume which passed down the West Fork. This will be true more or less according as the actual flood differed from what we call the normal basin ratios, but in any event it would be within a thousand feet of that, so the figures may be taken as approximate.

In the flood of 1887 we had an actual measurment in the West Fork made by myself at Kedzie avenue. That flood culminated on February 10, and reached a volume of 7,800 second feet. The volume was measured at the same time at the mouth of the Chicago river where it includes the local drainage of the Chicago river basin, at something over 10,000 second feet, of which the local basin only contributed a minor fraction or the difference.

The flood of 1892 in the West Fork is computed from the gauge reading and slopes as taken in that year, but no direct measurement was made, and this computation from the

1371 hydraulic elements gives a volume of 7,700 second feet, which together with the volume at Joliet, corresponds

almost exactly with the theory of normal basin ratios. In other words, the sum of the floods at Joliet and at Kedzie avenue on the West Fork is 20 per cent. in excess of that of Riverside which it should be by theory. As to what proportion of the flood went by way of Mud Lake and the Chicago river, I would say that in these three floods the ratio varies from 60 to 70 per cent. of that passing Riverside. The proportion passing Joliet was 50 to 60 per cent. of that passing Riverside; the aggregate being from 110 to 130 per cent. of that at Riverside. The reason for that is the increase of drainage area. There is not only the 173 miles in the Desplaines valley itself, but that portion also east of the range line which would raise it up to something over 200 miles. As to how far those proportions that I have given would hold for rises of water which might not be called floods, I would say that we call everything a flood down to 4,500 second feet and it holds down to that limit as indicated by the measurements in 1887 and also by measurements made in 1885. For instance, we have a measurement in September, 1885, following the great rain storm which precipitated the sewage
1372 of Chicago into Lake Michigan and led to the investigation of the sanitary question—we have measurements at riverside between 3,600 and 4,200 second feet, sometime in September, the date I do not recall. The volume down the West Fork was 3,244 second feet, and the volume passing Lemont was only 707 feet below the 12 miles level, although the gauge at Summit stood .9 of a foot above the level of the Ogden dam, which showed a remarkable condition of obstruction in the direction of the flow down the river, which can only be explained by vegetation in the 12 mile stretch. The proportion at the lower stages varies greatly with the conditions. The volume which I have stated as flowing at the crest of the Ogden dam represents the maximum volume down the valley, when it is entirely free, for instance, in the spring floods and the spring waters.

I am satisfied that this ratio substantially holds down to 4,200 second feet; that at some point below that the proportion passing toward the Chicago river diminishes until the water reaches the level of the Ogden-Wentworth dam when it substantially controls down the valley.

As to how the height of the Ogden dam corresponds with the greatest height of land lying between the Desplaines river

and the Chicago river, I would say that the Ogden dam
1373 was fixed as nearly as may be at the height of the natural banks in the vicinity, and is at an elevation of 11.73 feet, or 1.23 feet above the height which is taken for the original divide between Mud Lake and the West Fork. The Ogden dam is across the old portage slough and is actually constructed on the range line, R. 12, 13, north of Summit. The original divide was about .1 of a mile, between .1 and .2 of a mile, east of Kedzie avenue on the water trail between Mud Lake and the West Fork, and that divide is prolonged southerly and there is a second depression near 11 feet in elevation which led in the direction of the Stock Yards arm of the South Fork by way of Brighton. This divide which I mentioned as lying .1 to .2 of a mile east of Kedzie
1374 avenue, is the original divide referred to in the reports of Philips and Graham, and Major Long, which divide was changed or cut out in 1852; the conditions were changed at that time.

Referring to the original government survey introduced in this hearing as Kramer Exhibit 1, which exhibit is a combination of McCullough Exhibits 1 and 2 in the State Case, People ex rel. v. Economy Light & Power Company. and the Mathewson survey, which is shown as Kramer Exhibit 2, and which is now here before me, there is a slight break between the water course emptying into the West Fork of the South Branch of the Chicago river and the water course emptying into the swamp surrounding Mud Lake; and in the Mathewson survey these two water courses are shown as a continuous water course from the West Fork of the South Branch of the Chicago river to the swamp surrounding Mud Lake. My explanation as to the reason for the difference of the two maps is

(Objected to as incompetent, immaterial and irrelevant)

1375 that the original survey failed to note the fact which is shown on the Mathewson map and which is referred to in the report of Long and Philips and Graham, and which is a feature which was known to exist also by the early observers here at Chicago, and that was the existence of a trench across the divide, which had been worn down by the passage of boats and of voyagers below the level of the divide, constituting the bed of a water course between Mud Lake and the West Fork. Mr. Mathewson depicted this on his map as a continuous

water course, which it was at moderate stages of the Desplaines river.

(Counsel for defendant moved to strike out the answer as not based on the knowledge of the witness, and the last portion of the answer, "Mr. Mathewson depicted this, etc.," as not responsive to the question.)

Q. The testimony in the case of Mr. Kramer shows that the original survey was made in 1821, and that the Mathewson survey was made in 1847. Assuming that to be correct for the purpose of this question, Mr. Cooley, would there be any explanation as to why Mr. Mathewson delineated this water course as a continuous water course, rather than showing the break?

(Objected to as incompetent, immaterial and irrelevant, and as calling for the conclusion of the witness and for his opinion on a matter as to which no foundation has been laid.)

1376 A. The Mathewson maps show features regarding the water system adjacent and near the canal in more detail, more comprehensively than they are shown in the original land surveys which were made in 1821; and this was noted as a normal feature to be placed upon a map, and would be so noted by anyone who observed it. I would say further than that that aside from the merely historic evidence in connection with that, we have the statements of people who are familiar with conditions at this point, which have been related to me personally, that such a trench existed within the memory of men who were living in Chicago within the last ten or fifteen years.

(Counsel for the defendant moved to strike out that portion of the answer beginning with "I will say further than that," as not responsive to the question and as being hearsay, not based on any personal knowledge of the witness.)

Q. Now, Mr. Cooley, considering this divide in a state of nature, based upon the computation and examination of the volumes of water in the Desplaines river and the topography of the Continental Divide, I will ask you at what elevation on the Riverside gauge the water would have flowed over the Continental Divide?

(Same objection.)

1377 A. When the water stood at 10.5 at the head of the 12 mile level at Summit, corresponding to 13 feet on the Riverside gauge, and a volume of 600 second feet, the water

in the portage swamp and channels connecting with the Desplaines river stood at the level of the Chicago divide, the natural level disregarding the trench, and water would be flowing over to the Chicago river to the extent of the capacity of the trench that existed below this level.

(Counsel for the defendant moved to strike out the reference to what would happen in the trench as not responsive to the question.)

Q. To make it responsive, I will ask that question, Mr. Cooley; if a trench existed there would the water have flowed through there at that elevation, at the elevation of 13 feet on the Riverside gauge?

(Objected to as no foundation laid, incompetent, immaterial and irrelevant.)

A. It would have flowed through to the extent of the capacity of the trench.

Q. Now, referring to your table, Mr. Cooley, how many days in the twenty years over which records have been obtained, would the water have flowed over the Chicago divide?

(Same objection.)

1378 A. In these twenty years covered by the table it would have flowed over the divide for an aggregate of 1,464 days, or an average of 73.2 days per year.

The contour map introduced in evidence as Kramer Exhibit 6, I would point out as the color which is represented by the elevation of 13 feet on the Riverside gauge is the margin between the sienna color and the neutral tint, which corresponds to 13 feet on the Riverside gauge and is an elevation of 10.5, taken as the elevation of the Chicago divide, the sienna tint extending up to 11.7 feet.

Q. At what elevations would boats pass over the Chicago divide without interruption or portage.

(Objected to as incompetent, immaterial and irrelevant, calling for the conclusion of the witness, no foundation laid, and as being generally uncertain and indefinite to the extent that no answer which may be given would be pertinent or material.)

Q. I will ask you, Mr. Cooley, in answer to the objection, if you have made a study of the topography of the Mud Lake region, including the Continental Divide and the country lying east of the Continental divide and the Chicago river, in connection with the elevations of the land and the elevations of the water in the Desplaines river.

1379 A. I have. Basing my answer on that, I would say that this map was further based on surveys that were made under my direction when I was chief engineer of the Sanitary District.

Q. Assuming a boat of shallow draft, at what elevations could boats pass from the Desplaines river across the Mud Lake region and over the Continental divide and into the Chicago river without making any portage between them?

(Same objection.)

A. At all elevations when the water at Summit stood at 11.73 or above, corresponding to an elevation of 13.8 on the gauge at Riverside, and to a volume of 1,052 second feet.

Q. Will you answer that question for boats drawing, we will say, 15 inches of water?

(Same objection.)

1380 A. That is the draft of boat I had in mind in making my answer.

Q. Referring to your table, how many days in the twenty years would that have been possible if the original condition of the Mud Lake region had remained as it was in a state of nature?

(Same objection, and the further objection that it assumes facts not shown by the evidence and predicates the answer of the witness upon those facts.)

A. That condition would have prevailed during the twenty years of this record for 952 days or an average of 47.6 days per year.

Q. Take it at an elevation between 13.8 feet and 13 feet, corresponding to an elevation of 10 feet on the divide, or 600 second feet in the Desplaines river, how great a portage would have been required for boats of this character?

(Objected to as incompetent, immaterial and irrelevant and on the ground that no foundation has been laid, and as calling for the conclusion of the witness.)

1381 A. Under the conditions stated of 13.8 falling to 13 feet, corresponding to the range between 11.73 feet and 10.5 feet at the head of the 12 mile level shown on this map by the sienna tint, the water would gradually diminish in depth upon the Chicago divide and when a portage became first necessary it would be about one mile in length, and when it had reached the level of 10.5 it would be two miles in length between the West Fork at Western avenue and the beginning of deep water in Mud Lake.

Q. Take it at an elevation between 13 feet and 12.4 feet

on the Riverside gauge, corresponding to a volume between 305 and 600 second feet, at an elevation of 9.6 feet on the Summit level, what portage would have been required?

(Same objection.)

A. This range on the Riverside gauge corresponds to a range between 10.5 and 9.6 at the head of the 12 mile level, and as the water drew down from the level of 10.5 boats could no longer pass between Mud Lake and the Desplaines river except light, and be entirely stopped, and a por-
1382 tage of one mile, possibly two miles would be required between Mud Lake and the Desplaines river, in addition to the portage of two miles between the West Fork and Mud Lake. In lieu thereof, or as an alternative thereto, a seven-mile portage could be taken between the West Fork and the Desplaines river at a point above Portage Slough, about one mile south of the township line, T. 38, 9.

The condition of the Desplaines river at this stage would be 305 second feet. Boats could pass with a draft of 20 inches down to Isle la Cache, or Romeo Island; thence down the declivity to Lake Joliet, it would be about 15 inches and probably the same at Treat's Island, near the mouth of the river.

(Counsel for defendant moved to strike out the answer as not responsive to the question, and as containing a conclusion of the witness not predicated upon anything appearing in the evidence.)

Q. When you say a boat drawing 20 inches could pass down to Isle la Cache, and a boat drawing 15 inches could pass from Isle la Cache to Lake Joliet, what do you mean as to the depth of the Desplaines river?

A. That there would be a substantial navigable depth of 15 inches between Isle la Cache and Mount Juliet.

(Counsel for defendant moved to strike out the evi-
1383 dence as being conclusions of the witness, and not predicated upon any facts shown in this record.)

Q. Mr. Cooley, you may state in answer to the objection by counsel for the defendant, what your conclusion is based upon; how you came to arrive at this conclusion, that there would be a navigable depth of 15 inches?

A. The stages of water are already given, and the volume which prevails, and this stage and volume of water, with the increment, with the volume due to the additional drainage as you passed down the stream, would be sufficient to produce

channels of the depth which I have stated, down the declivities as they actually existed in nature.

(Counsel for defendant moved to strike out the answer as not responsive to the question and as containing conclusions not predicated upon any evidence in the case.)

I have made a study of the physical conditions of the Desplaines river bed. My answer is based upon that investigation. Referring to my table, as to how many days in the twenty years this condition would have existed, the aggregate period at which the water stood at or about a stage corresponding to 305 second feet, 2,324 days, or an average of 116.2 days per year.

1384 Q. Now, take the elevation between 12.4 feet and 11.85 feet on the Riverside gauge, Mr. Cooley, the latter corresponding to a volume of 100 second feet; what would have been the condition respecting the elevation of the Chicago divide and the Desplaines river and the navigation thereof?

(Objected to as incompetent, immaterial and irrelevant, on the ground that no foundation has been laid and as calling for the witness's conclusion.)

A. The Chicago divide would require the two portages already mentioned, from the Chicago river to Mud Lake and from Mud Lake to the Desplaines river, or the alternative of the seven-mile portage between the waters of the Chicago river and the Desplaines.

Q. What would be the condition of the Desplaines river from Riverside to the mouth?

1385 (Same objection.)

A. The Desplaines river would have ample depth through the 12-mile level and from the end of this level down to Romeo, a distance of 6.7 miles, it would have a navigable depth of 12 to 15 inches, with possibly some deficiency in one or two localities; and from Romeo down to the head of Lake Joliet there would be sufficient water for a boat at the higher stages to go down partially loaded, and at the lower stages to go down light, but at the lower stages the cargo itself would require a transfer over the eleven miles from Isle la Cache to Mount Juliet. All the river below the head of Lake Joliet would be navigated by discharging the cargo in part or wholly at Treat's Island, and near the mouth of the river.

Q. Referring to your table, what would be the period in which navigation would be complete or partial for any year?

(Same objection.)

1386 A. The aggregate period during the twenty years is 3,813 days, or an average of 190.65 days per year.

This average of 190.65 days per year would include the time when the boats could go down without any interruption of navigation. All those aggregates and averages are inclusive, including the periods given before. To separate them it can be done by subtracting one from the other. In other words, the difference for this particular period would be the average, 190.65, minus 116.2, which would be 74.45 days.

Q. Did you state, Mr. Cooley, when the elevation was 12.4 on the Riverside gauge, what would be the condition of navigation between Joliet and the mouth of the river?

A. I believe I did.

Q. Will you repeat it here?

(Same objection.)

1387 A. For a full load, at 12.4 feet, corresponding to a volume of 305 second feet, it would be necessary probably to lighter the cargo for a very short distance at two points.

Q. What would be the condition at an elevation of 13 feet on the Riverside gauge for the branch of the river between Lake Joliet and the mouth?

(Same objection.)

A. A boat could pass down without any obstruction with a full load.

Q. I call your attention to a statement in the report of Philips and Graham, already in evidence, which says:

"Supposing that that evil were remedied by a lock to lift vessels into the Plein, yet the Plein during half the year does not contain water enough to float a boat and so could not become useful as a national highway,"

I will ask you as a civil engineer, having in mind the topography and condition of the Desplaines river and the Desplaines river valley and basin, what is the meaning of this expression.

(Objected to as incompetent, immaterial and irrelevant, calling for the conclusion of the witness which cannot be competent as to the meaning of the parties when they wrote that report; and because the further

portions of the report show clearly what the meaning of the writers was.)

1388 A. They had reference, in my judgment, to contemporary projects respecting commercial waterways then projected or building. For instance, the Erie canal was then under construction for a depth of 4½ feet; the Ohio canals were projected and built and are still operated for that depth; and in the reports of surveys of the State of Illinois we have an estimate belonging to the subsequent decade which was for waterway four feet deep. Philips and Graham had in mind a national highway which would correspond to what was then being done in other parts of the country, and in my judgment contemplated something of that kind in the statement made.

Q. To what size boats does he refer?

(Same objection.)

A. Not less than probably approaching four feet in draft.

Q. Was there ever a condition, Mr. Cooley, when the Desplaines river ran absolutely dry and there was not any water passing from pool to pool?

1389 (Same objection.)

A. There has been no such condition except as it was artificially produced by the abstraction of water from the Desplaines either for canal purposes during the time in which the Desplaines was used in that connection as a feeder, or through the cutting down of the Chicago divide and the draining of the water entirely toward Chicago, that is, I would not say entirely; draining the water towards Chicago at medium and low stages.

The proportion of the route by the Desplaines river which consists of pools is about 60 per cent. The condition of these pools in extreme dry years, basing my answer on such investigation as I have made, would be that the water would follow down to the lip or outlet of the pool if there was no water running, or the floor of the outlet of the pool if there was no water running at all, and would approach this level in years of extraordinary depletion or drought. The

1390 condition of the pools in those years would be that they would have all the depth that they had below that level; and under those conditions about 60 per cent. of the route from Lake Michigan to the mouth of the Desplaines river would consist of pools of standing water.

The distance from the head of navigation on the Chicago

river, what is known as the forks of the Chicago river, to the Ogden dam is 8.3 miles by the old water course; by the portage road it would be about .3 miles less, about 8 miles. The proportion of the Desplaines river itself from the end of the portage road to its mouth, or confluence with the Kankakee, that would consist of pools, would be about the same, 60 per cent. The total distance from the portage road to the confluence with the Kankakee is about 44.5 miles. In that distance, there would be the so-called 12-mile level, which is 13.7 miles, Lake Joliet, the pool below Treat's Island, and Lake Du Page, aggregating 10 miles, and Goose Lake and Round Lake, and some other stretches unnamed,
1391 amounting in all to about 27 or 28 miles out of a total of 44.5 miles. The distance from Dam No. 1 to the mouth of the river is 15.72 miles, of which about 10 miles consists of pools. The condition of these pools if the Desplaines river was to run dry, that is, no water pass from pool to pool, would be that Lake Joliet would be practically as available for boats as before, the depth in it being on the first profiles we have from 20 to 25 feet at the maximum, and a large proportion of it having more than 10 feet.

In making these computations that I have made, I have taken into account an an engineer the increase of volume which would result from the increase of drainage area as I went down stream. The increase in area and corresponding increase in volume under natural conditions down to Lemont would be about 22 per cent.; Romeo about 25 per cent.;
1392 Joliet about 33 per cent.; the head of Lake Joliet about 54 per cent.; and below the mouth of the Du Page river, about 125 per cent. additional. Supposing you had a volume of 100 second feet at Riverside, the volume at the mouth of the river would be 225 feet. This percentage computation that I now have in mind was made within the last two weeks. The data respecting the basin of the Desplaines river in regard to the relative area was based on field work and maps made under my direction in 1887. The changes that have been made in the condition of the Desplaines river from its condition as it existed in a state of nature are that the portage swamp region lying east of the range line at Summit, R. 12-13 E., has been drained out and made tributary to the Chicago river, except so much thereof as is tributary to the canal, this area amounting to 48 square miles. There has been added from the Sag region an area of about 12 square

miles, making the change below Lemont 36 square miles to be subtracted from the former areas.

Referring to the table computed from the Riverside gauge, as to the number of days when water was at a cer-
1393 tain stage during a period of 20 years, during which there was a deficiency of rainfall averaging 2.9 inches per year, as to how these averages would have been if there had been a normal rainfall, I would say that the deficiency in run-off is always much greater than the deficiency in rainfall, so that the diminution of rainfall by 2.9 inches, or between 8 and 9 per cent., would produce a deficiency in run-off of a much larger percentage, probably 15 or 20 per cent., and the effect of that would be to diminish both the volume and the duration for the stages that are exhibited in this table. In other words, under natural conditions the stages would have been longer; I mean under natural conditions and normal rainfall the stages would have been longer. As to other influences that have occurred which would make the stages as computed from the actual records at Riverside longer, there is an absolute deficiency in the run-off due to the clearing away of the forest covered area, or the substantial clearing away thereof. Taking this at 40 per cent. of the original area and assuming that three-fourths of it had been removed, that deficiency would amount to about .6 of an inch over the whole basin, and based on
1394 a run-off of 12 inches in depth, is 5 per cent. The absolute substraction of water from the run-off due to this cause would probably amount to 27 or 28 second feet for the average rainfall.

(Whereupon counsel for the Government offered in evidence the table to which Mr. Cooley referred and asked to have it copied into the record.)

1395 (The document so offered and identified, is in the words and figures following, to wit):

"RIVERSIDE RECORD.

Number of days at Which The Riverside Gauge Stood at or above Certain Elevations in 20 Full Years From 1887 to 1910, inclusive.

(a) Elevation at or above 18.0 ft. corresponding to the crest of spillway at elevation 16.25 ft. and an ele-

vation of 13.6-14.0 ft. at Summit and a volume of 4,500 second feet.

(b) Elevation at or above 13.8 ft. corresponding to the crest of Ogden-Wentworth dam at elevation 11.73 and a volume of 1,052 second feet.

(c) Elevation at or above 13.0 ft. corresponding to original Chicago Divide at elevation 10.5 ft. (Summit) and a volume of 600 second feet.

(d) Elevation at or above 12.4 ft. corresponding to elevation 9.6 ft. at Summit '12-mile level' and a volume of 305 second feet.

(e) Elevation at or above 11.85 ft. corresponding to volume of 100 second feet and elevation 8.8-8.9 ft. in '12-mile level.'

1396

	Precipitation at Chicago, Inches.	(a) 18.00 ft. C.D.	(b) 13.80 ft. C.D.	(c) 13.00 ft. C.D.	(d) 12.40 ft. C.D.	(e) 11.85 ft. C.D.
1887	29.13	5	65	88	175	260
1889	34.95	0	34	60	107	168
1893	27.47	5	59	89	114	162
1894	27.46	3	38	65	103	149
1895	32.38	1	15	21	35	84
1896	33.14	0	12	35	122	216
1897	25.85	9	76	96	134	162
1898	33.77	6	45	58	93	194
1899	26.49	0	25	42	91	139
1900	28.65	0	31	41	104	194
1901	24.52	5	25	31	38	236
1902	37.57	1	68	116	169	225
1903	28.09	6	64	85	151	242
1904	26.14	11	51	62	79	118
1905	35.36	4	36	58	98	256
1906	30.87	2	48	92	128	257
1907	35.10	8	85	152	181	220
1908	34.83	10	67	97	123	168
1909	43.22	5	65	100	144	190
1910	26.86	6	43	76	135	173
TOTAL		87.0	952	1,464.0	2,324	3,813.0
Ave	31.09	4.3	47.6	73.2	116.2	190.65

Note: The average precipitation for 28 years 1843 to 1870 is 34.66 inches.

1397 The average precipitation for 40 years, 1871 to 1910 is 33.52 inches.

The average precipitation for 68 years, 1843 to 1910 is 33.99 inches."

NOTE: Counsel for government asked leave to withdraw this table and substitute therefor a corrected table. Transcript, p. .....; Abstract, p. ..... Subsequently a corrected table was offered and appears at transcript, pp. 2289-2290; abstract, p. ..... A list of the corrections appears at transcript, p. 2291; abstract, p. .....

1398 Q. Mr. Cooley, we were speaking about the deficiency in rainfall and the other causes that would prolong the stages as computed upon the actual records at Riverside. I will ask you to how great an extent would the volume of water and the duration of that volume have been increased if the state of nature had continued down to the time when the record was computed, if you can state.

(Counsel for defendant objected to the question as incompetent, immaterial and irrelevant and as calling for conclusions based upon data which does not appear from evidence in the record, and on the further ground that no proper foundation had been laid.)

1399 Q. Are there any other influences which would make the stages as computed from the actual records at Riverside longer?

A. Aside from the influences already mentioned which go to the question of the actual run-off there are changes which have profoundly affected the distribution of that run-off. The clearing away of the forests themselves has destroyed an element of control which has diminished the control and the duration of stages of water; and in addition thereto the restriction of ponds and lakes and the drainages of wet lands, bogs, and marshes, and particularly the destruction of a special control existing in the portage swamp region and 12-mile level, all of which under natural conditions prolong the stages of water.

(Whereupon the previous question objected to by counsel for the defendant was read; same objection.)

1400 A. The direct computation of this matter from the data which has been given is a matter of some difficulty and requiring more study and time than has been given to it. We can, however, reach the matter approximately by comparison with the flow of streams in the Illinois river basin which have not suffered the changes which has taken place in the Desplaines river basin. We have the Illinois river itself, which represents the aggregate effect of all the waters that are tributary thereto, in which the low water stage, as given by Wilson, is 60 to 90 days. I refer to General Wilson in the official report of 1867 and 1868. We have also the report of Captain W. L. Marshall, made in 1890, an official report, in which the low water stage is stated to be 42 to 62 days in which the dams would be required for the improvement of the lower river.

I am familiar with the Kankakee river basin. The Kankakee river basin differs in the control, and I was about
1401 to cite the Kankakee river basin as throwing some light upon the question of the length of time in which the volume would have been prolonged if the state of nature had continued in the Desplaines river valley.

Q. You may proceed to do so.

(Same objection.)

A. The deduction of Captain Marshall is based on a stage 2 feet above low water and a volume between 2,100 and 2,400 second feet for the lower Illinois river, at which the dams would be necessary for the navigation for this period of 42 to 62 days. This volume of water corresponds to about the eight months' flow in the Kankakee river and basin. The Kankakee river basin above Wilmington has an area of 4,926 miles, and above Momence and in the Iroquois basin it has a very large swamp control and lakes and the usual proportion of forests. Its control is so effective that floods at Momence are not over one-third of what they would be if this control was eliminated; and at Wilmington not over two-thirds or 60 per cent. of what they would be. The Kankakee river at Wilmington exceeds a volume
1402 of 2,350 seconds feet for eight months. Its usual low water volume is 1,300 second feet and the extreme low water volume is about 420 second feet.

Under the original conditions existing in the Desplaines river basin at least one-third of this basin had as good control as the Kankakee river basin; another one-third had a better control than it has at the present time; whereas the remaining third can be assumed as about equal to the present conditions for the whole basin. Taking these factors and including them in the proper ratio to the run-off for the Kankakee basin for eight months, for instance, we would have 150 feet of water at Riverside, and at the head of Lake Joliet 231 second feet, and at the mouth of the river about 340 second feet. The usual low water volume at Riverside would be 83 second feet, and at the head of Lake Joliet 128 second feet, and below the mouth of the Du Page river 187 second feet, and the low water volume at Riverside would be 27 second feet, and at the head of Lake Joliet 41 second feet, and at the mouth of the river 61 second feet. From that we would infer and do infer that the volume of 100 feet which we have used in the table for Riverside would prevail for more than eight months.

The other stages and volumes of water would be increased in the same proportion.

1403 Q. You testified, did you not, that at the elevation of 13 feet on the Riverside gauge, the Desplaines river would be easily navigated, and that this stage as shown by the table exists an aggregate of 1,464 days in 20 years, or an average of 73.2 days per year. How would that be?

(Same objection.)

A. That stage would be prolonged from 40 to 50 per cent.

(Whereupon counsel for defendant took issue with counsel for the government as to the use of the word "easily" in the question.)

Q. Could it be easily navigated at 13 feet, Mr. Cooley?

(Same objection.)

A. It could.

1404 The map which is now shown me, marked "Parry Exhibit 2," labeled "Chicago Divide from the Chicago river to Lake Joliet," was prepared by Mr. Thomas F. Parry under my personal direction. The part which Mr. Parry played in the preparation of this profile was that Mr. Parry was available and knowing well the records of the Sanitary District, I engaged him to prepare a profile which would show from these records and surveys the lowest line and the true profile from the Chicago river to Lake Joliet and to consult such maps and data as was available and had been taken prior to 1892. We discussed the scale of the map and he went ahead and prepared this profile as here shown. From time to time I scrutinized his work to see whether it accorded with my knowledge of the situation; otherwise, however, he has followed strictly the data which he has consulted and has delineated it on the map without any suggestion from me, otherwise than in regard to the hypothetical lines. There is a hypothetical line at Joliet which assumes by a dotted line to show the bed of the river as it existed before the dams were built at that point; also one at

1405 Lockport before the dam was built; and a flood line in the Mud Lake region which undertakes to show where the flood of 1892 would have gone if the original divide had existed.

Mr. Parry has made an error in regard to this flood line which I would like to have corrected on this map and I will explain that. I instructed Mr. Parry to prolong the flood line as shown at the west end of the portage swamp over the divide, but in place of prolonging the tangent which comes

from the Desplaines river into the swamp for two or three miles, he prolonged the tangent next below after the water had been drawn down by the drains and channels which have been made in the Mud Lake region and to the West Fork since 1852, and brought that line lower than it should be. The line prolonged would pass over the Chicago divide at an elevation of about 14 feet. That line passes over there on the map at about 12.67 or 12.5, somewhere in that vicinity. But otherwise I have discovered no departure from the data which he used in any respect, and the map I consider to be substantially correct and to represent the conditions so far as they can be depicted on that scale which is rather small. I should have liked to have made it on a much larger scale in order to bring out more details.

The data in red on this map is entirely my own and
1406 was put on strictly under my supervision, and I am responsible for that.

The table of original distances on this map was compiled by Mr. Parry from the data shown by the profile, with the addition of the distances from the end of the profile to the mouth of the Chicago river and to the mouth of the Desplaines river under my general direction.

Q. Is the data in its original form capable of being presented in a form that will be understood by the ordinary layman or person other than a civil engineer or a man familiar with the making of data of this sort?

1407 (Objected to as incompetent, immaterial and irrelevant, and does not indicate what data is referred to, and that the conclusion of the witness as to whether a layman would understand it or not is not competent.)

Q. Well, I will ask you what that data is, in answer to the objection.

A. Most of the data used on this map now on file in the Sanitary District was secured under my personal direction; they represent data that was made or secured by the City of Chicago in 1885 and 1886 and 1887, of which I had supervision when I was connected with the Drainage and Water Supply Commission and further data that was secured while I was Chief Engineer of the Sanitary District; and, in addition, the survey and map of Captain W. L. Marshall, made in 1889, was consulted, so I am familiar with the material that was used in the compilation of this profile.

(Whereupon the previous question was read as follows:

"Mr. Cooley, is the data in its original form capable of being presented in a form that will be understood by the ordinary layman or person other than a civil engineer or a man familiar with the making of data of this sort?")

(Counsel for the defendant, in addition to the grounds of objection already stated, objected to the question on the further ground that a summary of the data is not produced and not specifically referred to or identified
1408 so that it can be examined either by layman or by engineers or other experts on behalf of the defendant; as incompetent, irrelevant and immaterial, and hearsay evidence, and calls for the conclusion without importing into the record any of the facts upon which the conclusion is based.)

A. It is not, because it represents material taken from charts and profiles that are very voluminous, and the surveys of different times platted to different scales, and the material for this profile has to be taken from the several sources and platted to a uniform scale and separated from irrelevant matter in order to develop and make evident and visualize the features which it is desired to consider; and the engineer himself in order to gain an understanding of the matter bearing upon the subject would have to do this very thing and would do this very thing for his own comprehension, and I assume from that, that the ordinary layman and the court would be far less competent to interpret it from the original sources.

(Counsel for the defendant, in view of this answer of this witness in regard to the map and the sources from which it is made, moved to strike the map and all
1409 evidence based thereon from the record for the same reasons as before stated in the objection to the last question put to the witness.)

The sources to which I have referred are now on file with the Sanitary District, with the exception of the Marshall map and profile, which is printed as a government document. In my experience as an engineer I have been making profiles of this character and supervising the making of other profiles of this character for thirty-six years. It is the usual way for an engineer in showing the lowest water in a river to represent it in the way it is represented on this map. Profiles, I may say, are always compiled for such a purpose in all engi-

neering work, and for the purpose of estimates and making estimates.

Q. You may now state, Mr. Cooley, as to what this profile shows as bearing upon the testimony of the navigation of the Desplaines river in a state of nature.

(Objected to as incompetent, immaterial and irrelevant, as based upon a document which is incompetent, immaterial and irrelevant, and as calling for a conclusion of the witness of which there is no evidence as to
1410 his competency; as referring to conditions in a state of nature as to which there is not sufficient evidence in the record either that the witness is competent or as to what those conditions were; and on the further ground that no proper foundation has been laid for the question.)

A. This profile shows the distances and true elevations of ground and water along the line between the forks of the South Branch of the Chicago river at Ashland avenue and the middle of Lake Joliet. Upon it is shown the depth of the water below low water and the character of the bottom, the mud that has filled in the 12-mile level as shown by red probings, the declivities of the stream as they exist; and through the Mud Lake region is shown the Ogden ditch, its surface and bottom as it existed at the time of the survey of 1890; and also the restored surface as taken from the contour map as it existed before any ditches were built or any drains constructed in the Mud Lake region. It shows also the high water line of 1892 as taken from actual bench marks from Hoyne avenue, one block west of Robey street in the City of Chicago, down to Lake Joliet.

This profile shows the Desplaines river as it actually existed at the time of these surveys, 1885 to 1892, as sub-
1411 stantially in its natural condition except as it may have deteriorated in the progress of time by the filling of the pools, and except as it has been modified or changed by the construction of the Illinois and Michigan canal at Joliet in 1848; except as modified at Sag where the canal occupies a portion of the original river and a cut-off was produced; and except as it was changed opposite the quarries of the Illinois Stone Company where a short bend was cut off and the river shortened about three hundred feet; but otherwise it represents the natural conditions of the river as they existed, and as they have existed except the dam at Lockport, which I forgot to mention.

1412 Q. Look at that line marked "High water in 1892," "h. w. 1892," and tell us what that would indicate in reference to the navigation of the Desplaines river.

(Objected to as incompetent, immaterial and irrelevant, as based upon a document which is incompetent, immaterial and irrelevant, as calling for a conclusion of the witness of which there is no evidence as to his competency; as referring to conditions in a state of nature as to which there is not sufficient evidence in the record either that the witness is competent or as to what those conditions were; and on the further ground that no proper foundation has been laid for the question.)

A. Under the conditions of water that existed in the high water of 1892, and in the absence of bridges and the dams at Joliet and Lockport, a steamboat drawing three feet of water could have passed from the Chicago river down to Lake Joliet and returned without difficulty, right over the top of the Ogden dam, under the natural conditions, assuming the Chicago Divide to have remained unchanged.

Q. You may answer the question now, assuming it to remain under natural conditions.

(Same objection.)

1413 A. Under the natural conditions, assuming no changes to have been made whatever, the same vessel could have passed from the Chicago river to Lake Joliet and returned without difficulty.

There have been no changes in the condition of the Desplaines river except those due to the progress of time and those who have been due to the depletion of the water from a state of nature. There have been very radical changes in reference to the depletion of the water, which you might call interferences with the flow of the water. To mention these changes in detail, I would say the first change of significance was due to the construction of the Illinois and Michigan Canal which was opened in 1848. This canal as completed under the trustees for the bondholders between 1843 and 1848, had a summit level about 8 feet above the Chicago datum, extending about 26½ miles from Bridgeport to a point called Jack's Lock, about a mile and a half below the Romeo Road. This was a modification of the original plan upon

1414 which work had been done prior to 1843, which contemplated feeding the canal from Lake Michigan, and gave to the canal a declivity of .1 of a foot per mile, or about

29 feet in the 29 miles from Bridgeport to Lockport. But, by the modified plan, there was a lift at low water of 8 feet at Bridgeport and about 10.9 feet at Jack's Lock, and a supply of water had to be obtained to feed this summit level, and sufficiently so as to feed it in opposite directions, the relative volume required being for low water of Lake Michigan about 41 per cent. towards the Chicago river and about 59 per cent. in the direction of the Desplaines valley; and at high lake about 30 per cent. in the direction of Lake Michigan and about 70 per cent. down the valley, the required volume in opposite directions varying from 30 to 40 per cent. towards Lake Michigan.

To meet this requirement the Desplaines river was used, the 12-mile level opposite the canal at low water being at canal level substantially. A feeder was constructed from the Calumet river at Blue Island, where a dam was erected 11 feet above Chicago datum, and a feeder with a declivity of about 3 feet and some 16½ miles long constructed through the Sag to the junction with the canal at Sag station.

Furthermore, in order to supply the deficiency which
1415 might occur in seasons of great drought a Dutch Wheel, a life wheel, or pumping wheel was installed at Bridgeport. In addition to these sources for the summit level, the canal itself crossed in the bed of the Desplaines river at Joliet by means of two pools created by Dam No. 1, and Dam No. 2, where the entire flow of the Desplaines river was intercepted. The canal left Joliet on what is known at the Channahon level, and this level at a point above Channahon received a feeder from the Du Page river, a dam being constructed across the Du Page river to supply this feeder opposite the canal.

Furthermore, the canal crossed the Du Page river at Channahon, in a pool, thereby intercepting the flow of the Du Page river.

Below Channahon we have the Dresden level, and this level received a supply from the Kankakee river by means of a feeder and an aqueduct crossing the Desplaines river about .6 of a mile above its mouth, and leading from the Kankakee river and a dam across the same about four and a half miles above the mouth.

The effect of the construction of the Illinois and Michigan Canal upon the water in the lower Desplaines river was that all the water of the Desplaines river about Joliet, and of the Du Page river above Channahon, was intercepted, and it was further supplemented by a supply from the Kankakee and

the Desplaines river itself was reduced to a mere rem-
1416 nant, 220 to 250 miles only, below the dams at Joliet and Channahon. When I speak of "reduced to 250 miles," I refer to the fact that the drainage of the Desplaines river was reduced to less than 250 square miles out of a total of 1428 square miles.

The second interference arose from the fact that in the location of the canal along the south and east side of the valley, the hill drainage was intercepted by the Summit level, and turned in part towards Chicago, and that on the tangent between Summit and Bridgeport it ran across the south arm of Mud Lake and intercepted that, cutting off the drainage and the reservoir control of that portion of the portage swamp region lying to the south of the canal.

And a third interference in order of time, was the construction of a ditch by the Cook County Drainage Commission across the original divide between Mud Lake and the West Fork of the Chicago river in 1852. This ditch was originally cut four feet wide and three feet deep, and by 1856 had enlarged a width of 40 feet and cut down to the level of the lake, showing great activity in the forces of over-
1417 flow in the direction of the Chicago river. The Mud Lake region was thus drained and made tributary to the Chicago river. The effect of this was the watershed of the Desplaines river east of the range line at Summit, or the Summit of the portage swamp was drained and made tributary to the Chicago river except so much as had previously been intercepted by the Canal to the south.

The effect of the building of the Illinois and Michigan Canal across the Mud Lake region and the construction of this drainage ditch which I have spoken of, was that it entirely destroyed, or took away, the reservoir effect of the portage swamp, restricting is to the 12-mile level. It had a further effect in that the divide was now much lower, and the river drained towards the Chicago river at a lower stage than the original divide at Kedzie avenue.

Q. At what stage did it originally drain, and to what stage did it drain after the erection of this Drainage Commission's ditch?

(Objected to as no proper foundation laid.)

1418 A. The elevation of the original divide is taken at 10.5. The elevation of the bottom of this drainage is below Chicago datum at the Kedzie avenue divide; and any volume of water above 600 feet under the original conditions,

would begin to spill towards the Chicago river. Under the new conditions a volume of water of three or four hundred feet would begin to spill towards the Chicago river.

The other interferences in the flow of the Desplaines river are that in 1866 to 1871 the Illinois and Michigan Canal was deepened on the original plan, the Summit level being cut out. This canal opposite the 12-mile level was 9 to 10 feet below the low water elevation, and 15 to 17 feet below the high water elevation, and took water by percolation from the river opposite.

The next cause of interference was the construction of the ditches in the Mud Lake region, the draining out of the western part of the swamp by Nickerson, Ogden and Wentworth contemporaneously with the deepening of the canal. The Nickerson ditch extended along to the vicinity of the canal on the old water course from Mud Lake. The Ogden-Wentworth ditch extended from the north, or west arm of

Mud Lake along the south line of Section 6, to the

1419 range line, and thence along the range line to the portage

slough, and finally broke through to the portage slough in 1871. This ditch was originally 20 feet wide, and five feet deep, but rapidly enlarged until it attained a width of 60 feet, as shown on the earliest surveys, and cut down to the level of Lake Michigan and below. The effect of these works was not only to drain the west end of Portage Swamp, but to make the Desplaines river at low water entirely tributary to the Chicago river, and this condition continued substantially until the winter of 1876-1877. This interference that I have mentioned was arrested temporarily by the ice interests in the 12-mile level, which constructed temporary dams at the beginning of winter in order to secure a flow of water for their ice fields in the 12-mile level, but the frail obstructions that they put up for the purpose of restraining the flow down the river in the winter time were promptly washed out in the spring.

In the winter of 1876-1877 the City of Chicago constructed a dam across the Portage Slough on the range line, R. 12-13, and fixed the height of that dam at 11.73 above Chicago datum, this height being at the natural level of the banks of the

Desplaines river in the vicinity, as nearly as may be.

1420 This structure was not effectively maintained, and at

low water of the river the ice interests, as before, proceeded to tighten up any leakage so as to control the low water flow down through the ice fields of the 12-mile level. I

saw the dam at various times from 1885 up to the time that it became obsolete by the construction of the works of the Sanitary District in 1893 and 1894. I made a personal examination of the ditches which I have mentioned, such as the Ogden-Wentworth ditch and the Nickerson ditch. I have rowed out the Ogden ditch clear to within 200 feet of the Ogden dam in a boat, in my capacity as Chief Assistant to the Drainage and Water Supply Commission, 1886-1887. The dam itself was not well maintained, as I have stated, and the repairs were not properly kept up so that there was a great deal of leakage and much on the ordinary flow of the river passed towards Chicago.

There were other interferences with the flow of the Desplaines river. There was in 1881, the legislature, or rather the General Assembly of Illinois passed a joint resolution known as the Munn Resolution, at the instigation of
1421 the State Board of Health, for the erection of pumping works at Bridgeport, in order to increase the flow of the water in the canal for sanitary purposes. The Illinois and Michigan Canal Trustees were instructed in this resolution in the event of the failure of the City of Chicago to erect such pumping works, that they were to restore the old feeders and obtain a supply of water for the canal in that way. These pumping works were to produce a flow of 60,000 feet, or so much thereof as the canal could be made to carry. The pumping works were actually erected and began operation late in 1883, but were not completed and operated continuously until accepted by the city, late in 1886. The canal was stated not to be adequate to carry this flow of 60,000 feet, and it was never actually pumped except when I was actually engaged in making a test of these pumping works for the City of Chicago. It did for a time carry as much as 50,000 feet, for a short time; but usually operated at 30,000 or 40,000 feet per minute. The inciting cause of this resolution was due to low water in the canal, it having been discovered that the original deep cut in place of carrying 24,000 feet only carried about 10,000 feet at the level of Chicago datum.

1422 A further cause of interference was the construction of the river diversion by the Sanitary District of Chicago, which was completed in 1893-1894, by which the Desplaines river was shifted to the west and north side of the valley so as to leave a site between the river as thus changed and the Illinois & Michigan Canal for the construction of the

drainage canal itself. In a distance of some twenty miles between the spillway and Romeo the river was changed for 13 miles and restricted to a comparatively narrow path. A spillway was constructed at the head of this river diversion about .6 of a mile south of the township of Lyons, T. 38, 9 N.; this spillway having an elevation of 16.25 feet above Chicago datum and controlling the flow southward up to a volume of 4500 second feet, which is recognized as the flood volume. This river diversion entirely eliminated the 12-mile level, and its broad expanses as a reservoir and destroyed the effect that it had in controlling and mitigating the stages of the river, and reduced the flow to a narrow channel along the north and west side of the valley. It had the further effect of controlling southward all the volume of water below 4500 second feet, but floods in excess of 4500 second feet divided and came toward the Chicago river as before.

1423 Another cause of interference with the flow of the Desplaines river was the construction of the drainage canal. The drainage canal was constructed upon the strip of land to which I have referred between the Illinois & Michigan Canal and the river diversion, from the west fork of the Chicago river at Robey street to Lockport, and was opened in January, 1900, and has been in operation since. Its capacity is 840,000 cubic feet of water per minute, or 14,000 cubic feet per second at the low water of Lake Michigan and at the high water of Lake Michigan it approximates 1,000,000 feet per minute. The canal has been operated under regulation by the Secretary of War at a volume of about 30 per cent. of its capacity or 250,000 feet per minute, 4,166-2/3 feet per second during the season of navigation, the volume being restricted at that time by reason of the Chicago river for reasons of navigation.

During the closed season it has been operated for a higher capacity, 300,000 to 360,000 feet of water per minute and in flood time it has discharged a much greater capacity. It

1424 is expected that the flow will be increased as soon as the Chicago river has been further improved so as to permit it to be increased, on account of the State law which requires a certain volume to be maintained in proportion to population.

(Counsel for the defendant moved to strike out the evidence of the witness beginning "It is expected that the flow will be increased," and continuing to the end

of his answer, as incompetent, immaterial and irrelevant.)

Q. Mr. Cooley, speaking about this 300,000 cubic feet per minute, and supposing a flow of 450,000 cubic feet per minute is introduced into the drainage canal, what effect does the broad expanse of the great lakes have as regulating that flow and as bearing upon what you said in your previous testimony in reference to Portage Lake and the 12-mile level and swamp area, upon the flow of the Desplaines river?

(Objected to as incompetent, immaterial and irrelevant.)

A. The Great Lakes constitute the largest natural reservoir for the control of the waters draining thereto that exists upon the face of the earth. This great water expanse controls completely the flow of its basin, reducing it and equalizing it so that the fluctuations are moderate, and thus enabling the entire volume of its watershed to be util-
1425 ized and put to beneficial use. The control that originally existed in the Desplaines river basin is precisely similar in character only differing in degree.

As to other interferences with the flow of the Desplaines river, we have, in addition to the causes mentioned, the effect of inhabitation, which has cut away the forests, thus absolutely curtailing the run-off and the destruction of other features, such as the drainage of swamps, wet lands, the restruction of ponds and lakes and the cutting out of the special reservoir control exercised by Portage Swamp and the 12-mile level, which have profoundly changed the distribution of the run-off.

Q. Mr. Cooley, what do these various changes or interferences with the exception of the building of the Sanitary District channel, some nine in number, tend to show regarding the present condition of the Desplaines river as bearing on the condition of the Desplaines river in a state of nature.

(Objected to as incompetent, immaterial and irrelevant and as calling for a conclusion.)

1426 A. They indicate that profound changes have taken place, that the flow has been materially and at times radically interferred with since the period of canal construction ending in 1848; and that, furthermore, the conditions in the basin itself have been profoundly changed as to the actual distribution of that flow. The Desplaines river is an impermeable subsoil and such control as was exercised thereon was surface control largely. The destruction of this sur-

face control has profoundly affected the flow of the water, much more radically than would have been the case had the ground been permeable.

Q. How are the stages of water prolonged today in the Desplaines river as they would have been prolonged has these changes not been made, Mr. Cooley?

(Objected to as incompetent, irrelevant and immaterial, and that no proper foundation has been laid.)

A. The stages of water have been much shortened. As I have already indicated, from relations which I have given respecting the Kankakee river basin as compared to the early conditions in the Desplaines river basin, I have stated that it has been 40 to 50 per cent, longer as indicated by the Riverside records.

1427 The distance from the mouth of the Chicago river from the Chicago river, across the portage swamp to the Desplaines river and down the Desplaines river by its water course to its mouth or confluence with the Kankakee on the original water trail is 58.23 miles. I have actually computed this distance from surveys and profiles. Mr. Forsyth, in his table of distances which he gives, which is already in evidence in this case, in giving the distance of 60 miles from Chicago to the mouth of the Desplaines river at its confluence with the Kankakee river, gives substantially the correct distance; it is remarkable that he should come so close unless he actually measured it.

In connection with my duties in planning the Sanitary district channel and in connection with making the investigations for the Water Supply Commission and others, I had occasion to investigate the historical conditions that formerly had existed in the Desplaines river valley.

Q. I will ask you as to what bearing the physical conditions in the Desplaines river valley, its topography and other features, have upon this historical accounts?

1428 (Objected to as incompetent, irrelevant and immaterial, and no proper foundation.)

Q. In answer to the objection of counsel for the defendant I will add to that question the following: Supposing the historical testimony to show that the early fur traders and explorers traveled by means of boats up and down this river at certain seasons of the year, what would the physical conditions and topography tend to show in reference to such testimony, Mr. Cooley?

(Objected to as incompetent, immaterial and irrelevant.)

A. They would tend to show that the river was entirely competent, or the water trail was entirely competent, for the uses which have been related in regard to it; in fact, I regard a knowledge of the physical conditions as essential in interpreting the facts of history in connection with this route.

(Counsel for the defendant moved to strike out all that follows the word "regard.")

1429 Q. Mr. Cooley, when La Salle said that it was only navigable for fifteen or twenty days in the year after which there was no longer any water, what must La Salle have had in mind considering the physical conditions of the Desplaines river.

(Same objection.)

A. Mr. La Salle had in mind navigation for boats of the class which he constructed—one of which he constructed on the Great Lakes and which he started out to construct at Creve Coeur to descend the Mississippi river. Those boats draw from two to four feet of water.

Q. If La Salle did not mean a boat drawing from two to four feet of water, what would you say, basing your answer upon the physical conditions of the Desplaines river, as to La Salle's hypothesis that the river was only navigable for fifteen or twenty days?

(Objected to as incompetent, irrelevant and immaterial, and on the further ground that it is not shown that the witness possesses knowledge which justifies his conclusion upon the point.)

1430 A. La Salle's statement is directly contrary to the knowledge which we have of the physical conditions of the river and makes it evident that Mr. La Salle did not know what those conditions were.

I have investigated in reference to the conditions as they existed in a state of nature and as they existed at the period just prior to the construction of the Sanitary District channel.

Q. Did you find there was any change from a state of nature down to the beginning of the construction of the Illinois & Michigan canal?

(Objected to on the ground that it is apparent from the testimony of the witness that he has not the data upon which to found an answer so far as concerns the conditions of the river in a state of nature.)

1431 A. There has not been any change from a state of nature except in the respects to which I have already given testimony, and I would say that broad climatic conditions have not changed; that the conditions in nature that existed in the day of La Salle are the conditions of nature that existed down to the time that this interference occurred.

Mr. CRESSY. At this point I request counsel for the defendant to produce the reference which he cites in the cross-examination of witnesses, in which he questions the witnesses to the effect that La Salle said that the Desplaines river had a current which resembled the river Rhone.

The WITNESS. Torrential currents.

Mr. MUNROE. He says they are stronger than the Rhone, right in that article you have before you.

Mr. SCOTT. I will assure you right now, Mr. Cressy, that if you have a reference there that refers to the river Rhone that that is the one I understand refers to the river Desplaines.

Mr. CRESSY. I will ask the reporter to copy this into the record:

> "The lake of the Illinois always forms a sandbank at the entrance of the channel which leads to it. I doubt very much, in spite of what anyone says, whether this could be cleaned out or cleared away by the force of the current of the Chicago river when it was made to flow therein, since much greater currents in the same lake cannot do it. Moreover, the utility of a canal would not be very great, for I doubt when everything should succeed if a boat could overcome the great floods which the currents cause in the Chicago in the springtime. These are much heavier than those of the Rhone. Again navigation would be for only a short time, at most for 15 or 20 days in the year, after which there is no longer any water. What confirms me still further in the thought that the Chicago river could not clean the mouth of the canal, is that when the lake is filled with ice, it blocks up the most navigable mouths at this time, and when ice is formed there is no longer water in the Chicago river to hinder blocking this canal with sand. Also I would not have made mention of this way of communication, if Joliet had not proposed it without sufficiently examining the difficulties."

And I will ask counsel for the defendant if that is the passage to which he refers.

Mr. SCOTT. That is the passage to which I refer and the passage is interpreted not only by what it says in itself, but by other portions of La Salle's account.

Mr. CRESSY. Q. Now, supposing, Mr. Cooley, for the purpose of this question only, this reference to refer to the Desplaines river, and having in mind the physical conditions of the Desplaines river, what would you say as to this statement of La Salle's?

(Objected to as incompetent, irrelevant and immaterial.)

1433 A. In the first place the statement would be limited to a fraction of the river, if it applied at all, and not to the whole river. In the second place there are no currents in the Desplaines river which I think are subject to the description which La Salle gives. We have much heavier currents that are navigated in this country on the Missouri and Mississippi rivers than exist in the Desplaines river in flood time on its steepest declivities.

Mr. SCOTT. I move to strike out the volunteered statement of the witness as not responsive to the question beginning, "We have much heavier currents," and continuing to the end of the alleged answer.

Mr. CRESSY. Q. I will ask you as to whether we have currents in other rivers in this country which are greater than those in the Desplaines river and yet are navigated?

(Objected to as incompetent, irrelevant and immaterial and as calling for conclusions of the witness rather than for the statement of facts upon which the conclusion is based.)

Q. Limiting your answer to the Missouri river and to the Mississippi river upon which you have testified you have had some experience.

(Same objection.)

1434 A. The currents that exist in flood time over the long declivity from Isle la Cache to Mount Joliet are less than those which exist in the Missouri river at bank full stage, and in the Mississippi river between Cairo and Memphis.

I would not call those currents that I have mentioned as existing in the Missouri river and in the Mississippi river at Memphis torrents. The word torrent is not applicable to anything that I have ever observed in the Desplaines river between the end of the portage trail and the mouth.

1435 An engineer can reproduce the past, for example, reproduce the state of nature as it existed in the Desplaines river basin, from what marks, monuments and other data is left concerning that state, with the same certainty that scientists like Professor Copey could reproduce an extinct mammal or Professor Agassiz a fish from bones that are left; or an astronomer could identify a comet or an eclipse that occurred before Christ. As to how he would do it in regard to the actual condition in a state of nature in the Desplaines river valley, we have a great deal of evidence, we have the original land surveys in which
1436 the characteristics of the land are actually noted at the time the survey was made; we have the geological reports in this state in which field men went over the district township by township, and described the topography, the topographical features and the wet lands and swamps and so on, and the lakes. We have in addition to that the evidence of the earlier surveys that were made through the valleys, and we have also the known effects that have been produced in valleys similar to the Desplaines river basin, and also valleys that existed and still exist unchanged; and we have the facts of history in regard to the effect of the denudation of forests and the drainage out of lands and other sources of control, and the effect that has been produced thereby.

With the aid of all these data and the necessary insight, adaptability, you may say, of the engineer to such problems, he can substantially reproduce the conditions of the past. In fact, I conceive it to be possible to produce a map today which would substantially represent the Desplaines basin in its original condition, and the water courses in the original condition before changes took place, and deduce therefrom the conditions of flow; and I have done this from time to time so far as it was necessary to from my own judgment in connection with this and other basins.

The description which occurs in the report of Stephen
1437 H. Long, dated Washington, March 4, 1817, already introduced in evidence in this case, in which Major Long says:

> "The river Des Plaines is a small stream rising in the low lands, bordering upon the west side of Lake Michigan, and has its general course in a southwesterly direction. The valley of this river has an average width of about one mile, and is terminated on both sides by regular banks, nearly parallel to each other, extending

along the river about 30 miles from the head of the Illinois,"

is a correct description of the Desplaines river valley in general terms, below the Sag, that is, from the Sag down to the mouth.

Q. Now, in the next sentence he says:

"In ascending this river, also, the banks or bluffs gradually decrease in height, being, as before mentioned, about 100 feet high at the mouth, and only 20 or 25 at the distance of 30 miles higher up the river, where, instead of maintaining their parallel direction, they form nearly right angles with the course of the river, that on the right taking an easterly, and that on the left a northwesterly course; but, being gradually inflected from these courses, they form an extensive curve, encircling a large tract of flat prairie, in no part elevated more than 12 or 14 feet above the common level of the water in this vicinity."

1438 I call your attention particularly to the following sentence:

"The river, throughout the above mentioned distance, has 4 or 5 short rapids or ripples that make their appearance only in times of low water."

Does that description of the Desplaines river correspond with the physical conditions as reproduced from the bench marks and other data you have spoken of?

(Objected to as incompetent, immaterial and irrelevant and further that the accuracy of the statement in Long is to be determined by proved facts and not by the verdict of the witness as to the accuracy of the statement.)

A. I think so.

Q. What ripples or rapids does he refer to by this last answer?

(Objected to as incompetent, immaterial and irrelevant.)

A. Treat's Island; one that existed at Lockport; one in the vicinity of Isle La Cache or immediately below it; and the short ripple or rapids at Lemont, I think would cover the special short rapids that he refers to.

Q. Having in mind, Mr. Cooley, the various data which you have referred to in reference to the condition of the

1439 Desplaines river, would you prepare a description that would correspond with this?

(Objected to as incompetent, irrelevant and immaterial, and as predicated upon and referring the witness to data, the nature or character of which has not been shown by the record.)

A. Writing a description like Long's, I think I would.

Q. Continuing, Major Long says:

"In every other part, it has the appearance of being a chain of stagnant pools and small lakes, affording a sufficient depth of water for boats of moderate draught."

Having in mind the data which you have referred to, would you say this was a correct description of the river?

(Same objection.)

Q. What are the stagnant pools and lakes to which he has reference?

(Same objection and the further objection that the witness is not competent to state what the writer had in mind.)

1440 A. He had in mind reference to such pools as Lake Du Page, the pool at Treat's Island, Lake Joliet, Goose Lake, Round Lake, the 12-mile level and Portage Lake.

I have in mind the same pools in making my answer. When I say it is a correct description of the Desplaines river valley, of the obvious features that existed in the days of Long, that is, more pronounced in his time than in the time of the surveys that are depicted on this profile.

Q. Continuing, Major Long says:

"In the flat prairie, above mentioned, is a small lake, about 5 miles in length, and from 6 to 30 or 40 yards in width, communicated both with the river Desplaines, and Chicago river, by means of a kind of canal, which has been made partly by the correct of the water, and partly by the French and Indians, for the purpose of getting their boats across in that direction in time of high water."

What does he refer to in that instance, having in mind the data to which you have referred?

(Same objections.)

1441 A. He refers to Portage Lake, which with its westerly arm is about 4 miles long and which probably, after the cutting of the Chicago divide filled up somewhat at the western end.

That portage lake is the same as Mud Lake and the same as depicted upon the map and the profile which has been

produced and introduced in evidence. Major Long was an officer of the United States sent out here to rebuild Fort Dearborn and he made this survey and made this examination in the line of his official duties.

Q. As a civil engineer after an investigation of the physical conditions of the Desplaines river valley, what would you say as to the correctness of the descriptions as given by Major Long?

(Objected to as incompetent, immaterial and irrelevant, and that the accuracy of the description is not to be shown by the opinion of the witness but by comparison with other facts shown by the record.)

A. I should say that Major Long was making a responsible examination for the purposes of an official report, and the statement of the facts that he discovered in that examination would have more weight than that of any writer preceding him.

(Counsel for defendant moved to strike out the answer as not responsive to the question.)

1442 Q. Mr. Cooley, is the description which you find in Major Long, the same in substance as what you would make, basing your conclusion upon an examination of the data and other evidence that you now are able to obtain?

(Objected to as incompetent, irrelevant and immaterial.)

A. I think so.

Q. Now, referring to the report of Graham and Philips, and especially to the following passage in which he says:

"On opening the canal, however, two difficulties would be experienced.

1st. The Plein would be found to be above the level of the canal; its water, of course, would be diverted from its natural channel, and pass by the canal into the lake.

2d. Supposing that evil remedied by a lock to lift vessels into the Plein, yet the Plein, during half of the year, does not contain water enough to float a boat, and so could not become useful as a national highway."

How would you explain this passage? What did Messrs. Graham and Philips have in mind when they say, "During half of the year the Plein does not contain water enough to float a boat?"

(Same objection.)

A. I think that he had in mind a commercial waterway
1442 such as the needs of that time required, and which is to be judged by what was regarded as a commercial waterway by works going on contemporaneously. For instance, we have the Erie canal under construction from 1817 to 1826, for a depth of four and a half feet. We have the Ohio canals projected about this time and still in existence and doing business on a depth of four and a half feet. We have in that period or immediately following it, I think in 1823 or 1824, a survey of this same route in which an estimate is made on the basis of an ultimate depth of four feet. We do have contemporaneous canals that were a much less depth, 30 inches and three feet, both in this country and abroad. It was something of that kind that Philips and Graham had in mind as a national highway.

Q. Now, referring to the field notes of John Walls in which he describes this part of the river which he meandered, namely, from approximately Lemont to the township line between townships 38 and 39, in range 12, which we now call Riverside, in which field notes he characterized the river as being a succession of pools, swamps and lakes connected by current, how could the physical conditions as shown by the topographical survey and the other data and marks which have been left from the past, correspond?

(Same objection.)

1444 A. They would fully justify the description given by John Walls as the conditions existing at the time he made that survey. It still consisted when we have our definitive and detailed surveys as a succession of pools connected by currents.

Q. Having in mind the topographical conditions of the Desplaines river valley and the bench marks and other data that have been left to us from the past, as to both the Desplaines river and the Mud Lake region, what can you say as an expert engineer as to the physical conditions justifying or not, or corroborating or not, the historical conclusions made by Professor Alvord and others in this case, that the Desplaines river was actually used by the fur traders and early inhabitants for the purpose of trade and commerce during some portion of each year.

(Same objection.)

A. From the physical standpoint it was entirely feasible to make such use as has been shown in the evidence of the historical experts. In fact, the physical conditions are bet-

ter adapted to such use than any of the water trails that formerly existed between the waters of the Great Lakes and those of the Mississippi.

(Counsel for defendant moved to strike out the answer beginning "in fact" and continuing to the end, as not responsive.)

1445 Q. What do the physical conditions and the data left to us from the past, the topographical maps and so forth, show us as to the ability to use the Desplaines river for trade and commerce in a state of nature?

(Objected to as incompetent, irrelevant and immaterial and calling for conclusion.)

A. They show that under natural conditions it was possible for a portion of each year to make an uninterrupted passage between the Chicago river to the Illinois river; that for another portion of the year there would be a portage from one mile or two miles in length; that for still another portion of the year there would be a second portage of about a mile in length, or an alternative portage of seven miles from the Chicago river to the Desplaines river, and during these three conditions boats could pass without interruption down the Desplaines river to its mouth, from the west end of the portage swamp region. A portion of the year boats would find local obstructions at a few points, and in the latter part

1446 of this stage boats would have to pass down light from Isle la Cache to the head of Lake Joliet and take their cargo overland and possible discharge at two or three other localities; and that at no time would there be more than 40 per cent. of the distance between the mouth of the Chicago river and the Illinois river in which the navigation would be hampered or limited.

Q. Is there any data or anything in the physical condition of the pools, lakes, bench marks and other data that are found in the Desplaines river valley to justify a conclusion that at any time there was absolutely no water in the Desplaines river?

(Objected to as calling for a conclusion based upon data the sources of which are not identified, and not shown to have been introduced in evidence and as calling for the conclusion of the witness.)

A. I think not.

Q. Take extremely dry years, supposing a year when there

was little or no water flowing between the pools, what would be the condition of the Desplaines river?

(Same objection.)

1448 A. It would be a succession of pools covering about 60 per cent. of the distance, with some water running between them.

Supposing there was absolutely no water running between them, the pools would drop to the level of the lip or the

1449 outlet of the pool and the water would be sustained at that level except as it may be lowered slightly by evaporation, and the pools would have substantially the capacity that they had at higher level as they are shown of considerable depth. The 12-mile level was generally several feet in depth, reaching up to ten or fifteen feet; Lake Joliet on the earliest profiles of it, the profiles of 1858, reached to a depth of 25 feet and was generally 10 feet or more in depth; Lake Du Page was 10 or 12 feet in depth or more; and there were some intermediate pools of shallow depth, two or three feet in depth, like Goose Lake and Round Lake.

Referring to this profile, Parry Exhibit 2, I stated this morning that the marks on there in red were put on by Mr. Parry pursuant to my directions.

My authority for locating Marquette's cabin in 1674-1675 at the point where it is marked here, right at Robey street, is that Marquette in his narrative or his journal states that he coasted down the west shore of Lake Michigan and

1450 entered the Chicago river, ascending the same to a point two leagues from the lake. Take that at six miles, it is exactly the distance to Robey street, and the entrance of the main channel of the Sanitary District of Chicago. At the time he stopped there on December 14th, 1674, he was unable to proceed further on account of the formation of ice which is stated to be six inches thick on neighboring lakes and ponds. He remained there during the winter and on the night of March 29th, without warning, is driven from his cabin by water, a rise of water, and goes to the trees. It seems he was camped in the woods and he secures his effects in trees, and on the following morning he retires to a near-by hillock, or takes refuge on a near-by hillock. The hillock referred to was a mound that stood adjacent to Robey street on the north side of the west fork of the Chicago river and was dug away by the brickmakers finally in 1882.

This hillock was some sixteen feet above Chicago datum, or above any probable flood limit in that vicinity. We have

in the flood line of 1892 at this point a rise of 8.1 feet above Chicago datum, which would have been sufficient to have driven anybody even at that time, out of a cabin located in that vicinity.

On March 31st the river having run clear of ice, he resumes his journey, passes over the divide and down to the country of the Kaskaskias or Peorias, without interrup-
1451 tion. In addition to the evidence of the hillock which is the only mound of that kind, and which was a very singular formation—existing about the Chicago river or any of its branches, it is on the direct line of his route to the Illinois river and is certainly the only evidence of that route between the portage and Lake Michigan, and the particular point is the only point about the Chicago river basin where a man could have been drowned out by a sudden eruption of flood waters which came from the break-up of the Desplaines river over the divide. For those reasons I have located Marquette's cabin at that point.

Q. In the course of your investigation have you ascertained as to whether historians or people in general agree with this location of Marquette's cabin?

(Objected to as calling for a conclusion from data which is not indicated and as incompetent, irrelevant, immaterial and hearsay.)

A. I have not see any historical account except what I myself have written with reference to the identical spot where this cabin was located; but have discussed it with Horace
1452 M. Singer and Ossian Guthrie, and I understand there is a manuscript in the historical society from Mr. Guthrie bearing upon that point, but I do not know that. The Sanitary District has erected a cross on the point of land between the west fork and the Drainage Canal in commemoration of Marquette being the first white man to winter at Chicago, which is within the vicinity of the original cabin or hillock, perhaps a hundred yards from it or more. I have seen this in passing up and down the Drainage Canal.

Referring to the marks "Second Portage, La Petite Lac, First Portage"; then underneath the words "Second Portage," "one or two miles"; underneath "La Petite Lac," "three or four miles"; and underneath the words "First Portage," "two miles," and then underneath all of them the expression, "The seven-mile portage," those are simply interpretations of points shown on the contour maps and on the land survey maps as to the location of Mud Lake and the

portage road. My authority for this figure in red, which is the portage slough, as indicated on this map, is that
1453 that identified a slough that is still in evidence on the modern contour maps and is shown on the map and in the notes of John Walls. The next letter in red, "the 12-mile level," is the name which has come down to our day and was commonly in use for that succession of pools which were used by the ice interests between Summit and Sag. The actual length of it is 13.7 miles from the Ogden dam down to the rock escarpment.

My authority for the next point in red, which is Isle la Cache, is that there is still a name on the map, on some of the old maps of Lilly Cache, which I take to be a corruption of "L'Isle Cache," applied immediately west of Romeo Island to the gulch extending towards Plainfield. The hill itself is the only island between Lemont and Joliet which is so situated above high water that cargoes or goods could be cached there without danger of floods, and is a characteristic island in that respect. The island is also situated at a radical change in the declivity of the stream and boats could go down to Isle la Cache or Romeo Island and there in low water would lighten their cargoes or cache them in part or carry them to Mount Juliet at the head of Lake Joliet where they would be again re-embarked, the boats passing down light.

1454 My authority for the point as at the further end of the profile, which is marked "Mount Juliet," is that Mount Juliet or Joliet, or Jolie, which it has been variously spelled, is opposite the head of Lake Joliet, below Brandon's Bridge and near the canal, and was originally an oblong isolated mound, what the geologists call a "drumlin" similar to the sea mound of Fitzpatrick mound above the controlling works of the Sanitary District and has always been known at Mount Joliet. I have seen it myself in earlier days, but it has been largely removed for the gravel and the clay which it contains. It was a singular and prominent feature on the landscape from the vicinity of the head of Lake Joliet.

The map which is now shown me is a map which shows the Desplaines river and the Illinois and Michigan canal, and the topography, and place names on and adjacent thereto, between Lockport on the Desplaines river and the E. J. & E. Railway on the Illinois river, together with a profile between basin number 1 at Joliet and the E. J. & E. Railway on the Illinois river. Its title is "The Desplaines River be-

low Joliet, Illinois." The scales are given graphically.
1455 This map was prepared under my directions by Edgar Williams in November, 1907, I think. The scale of the map is one inch to the mile; the scale of the profile is one inch to the mile horizontal and twenty feet to the inch vertical. The profile shows the river as exhibited by the Board of Army Engineers in the report of 1905, H. R. 263. It follows the north channel at Treat's Island, which was the channel taken for improvement, and the profile itself is along the line that they laid out for improvements and for the purpose of estimates. The low water of 1901 is shown on this profile. That low water is taken from the profile of the Board of Army Engineers and corresponds to somewhere in the
1456 vicinity of 4,000 second feet, but it is not stated in the report. It is marked on here 4400 second feet, at Joliet. I presume that is correct. I vertified it at the time it was made, and that was the volume that I had from some source at the time the map was made. I have already stated that I prepared a number of profiles of this character. I superintended the preparation of this profile sufficiently so that I am ready to swear it is accurate and correct in all respects. It is a correct reproduction of the profile in the official report, except the difference in scale.

Q. How does this profile, for example, compare with the profile in the official report of 1905?

(Objected to as incompetent.)

A. The profile of 1905 was prepared for the purpose of exhibiting the very flat slopes of the lower river and the
1457 scale is very much exaggerated when it comes to the steeper slopes of the upper part of the Illinois river, and the Desplaines; too much exaggerated to be useful to engineers; and the profile scale here adopted was that which was deemed best to properly visualize the profile for the Desplaines river.

That is the only respect in which this profile differs from the profile of 1905, except there is added to the profile the location of a proposed dam at the mouth of the Desplaines river. This profile accentuates the slopes. It is necessary to accentuate the slopes in order to visualize them so that they can be studied. A slope in its natural relations ordinarily would not be discernible to the naked eye and the vertical scale on the same basis as the horizontal scale would reduce the water to a mere film which could not delineated on a map or profile.

This profile shows the bottom of the river as of the year

1899, which was the survey of the Barlow Board which was used by the Ernst Board which reported in 1905.

1458 The high water of 1904 was determined or reported by the Ernst Board in its report of 1905. It is a natural line determined by connecting up the high water marks by a system of levels. This map also shows the location of the Illinois and Michigan canal, the topography by contour lines adjacent to the Desplaines river and to the canal, the tributaries as they approach the Desplaines river and the places named.

Whereupon said map was offered in evidence.

(Objected to as incompetent, immaterial and irrelevant, and as showing conditions in the river not in its natural state but as modified by the building of the Illinois & Michigan Canal and the Sanitary District canal.)

Whereupon counsel for the government requested that for the purpose of preventing obscurity in the record, the map be marked Cooley Exhibit 2, because it is so marked in the state case, and further stating that there would be no Cooley Exhibit 1.

(Said Cooley Exhibit 2 appears in the Appendix, page.....)

Whereupon counsel for the government produced another map.

1459 Mr. COOLEY continues: This map which is now shown me is a profile of the Desplaines river and the Illinois river from the upper basin and dam number 1 at Joliet to the E. J. & E. Railway, across the Illinois river, below the mouth of the Desplaines river. The map is entitled: "The Desplaines River from Joliet to the Mouth." The scale is 2,000 feet to one inch horizontal; 10 feet to the inch vertical; and the elevations on the map are below Chicago datum. The distances on the map are given in thousand feet below the power station of the Sanitary District, dam Number 1, being 14,200 feet on the scale below said station.

This map was prepared by Edgar Williams under my direction in 1908. It states as authority the following: "The bottom and low water line from survey of 1883, as reported by Captain W. L. Marshall in 1889. The data have been compared with that of the United States surveys of 1899-1900 and of 1902-1904, and reduced to the final precise levels of the last survey. The flow lines are from diagram prepared

1460 by James A. Seddon for the Sanitary District of Chicago in 1901-1902." There is a small band of blue on this map between the levels of 4,000 second feet and 6,000 second

feet, which is meant to represent the habitual stage of water produced at low water of the Desplaines river since January, 1900, when the Sanitary District water was turned into the river.

In connection with the preparation of this map and the checking up of various data, I would state I followed it very closely to satisfy myself that it was correct and accurate in all respects. What I said in reference to the visualization and the slopes and depths on Cooley Exhibit 2 would also apply to this map. The vertical scale on this map is twice that of the other map; and the horizontal scale is about two and a half times that of the other profile.

Referring to Treat's Island, the profile on this map follows the main channel of the Desplaines river to the south or left of Treat's Island. It follows the line of deepest water
1461 as shown on the charts from dam number 1 to the end of the profile, and in that respect it differs from Cooley Exhibit 2 which shows the north or west channel. The line which is here given as the top of the blue coloring marked L. W. 1883, is the low water of 1883. That was determined from the Benyard survey. It has been the official low water since used in all the surveys. This flow of water is the very low water of the Desplaines river. The river has very rarely gone below it, and it is the limit, you may say, for the low water of the river as it existed for twenty to thirty years, except with two or three exceptional years. It is a much lower stage than the normal of the river and represents a limit rather than the habitual stage of the river, because the usual stage is much higher. The lines which are marked on
1462 this map 2,000, 4,000, 6,000 and 13,000 second feet, extending down the length of the map represent the stage of water that correspond to the volume entered upon the lines under conditions of steady flow. These lines were determined by Mr. Sheldon officially for the Sanitary District to indicate the expectation in regard to various volumes of water to be turned down the Sanitary District canal, and were prepared from the gauge records and all the data existing at that time. They were prepared in 1901 and 1902 and express the knowledge existing at that time of the stream. I have gone over them with the aid of the later data but did not ascertain any discrepancy that justified changing the same. This blue band which lies between 4,000 and 6,000 second feet, represents the present flow of the Desplaines river. It is the line between

which the flow in ordinary seasons of the year has varied; the mean flow being taken at about 5,000 second feet.

Whereupon counsel for the government offered the
1463 said map in evidence, and asked to have it marked Cooley exhibit 3.

(Objected to as incompetent, irrelevant and immaterial, and specifically on the ground that it shows conditions after the natural condition of the stream had been altered by artificial means, and that it purports to show possible future conditions which did not exist.)

Whereupon counsel for the government stated that he admitted the contention that it did not show the actual conditions in a state of nature; that the said map was offered for the purpose of showing the changed conditions and the present conditions.

Whereupon said map was offered as Cooley Exhibit 3.

(Said Cooley Exhibit 3 appears in Appendix, p. .....)

1464 Mr. COOLEY continues: I know what the flood volume of the Desplaines river is. For the flood of 1904, it is stated in the official report as 22,000 near Joliet, and 28,000 feet at the mouth.

Referring to the line shown on this map marked H. W. 1892 and also H. W. 1904, namely, on the slope near Lake Joliet in which in dotted lines is shown the words "H. W. 1892." The explanation of these marks is the flood line of 1892 below dam number 1 at Joliet was taken over the dams then existing, which were dams 2 and Adam's dam. These dams have since been removed and the river regulated and improved down to McDonough street, Joliet, and the flood line of 1904 was entered there for the purpose of continuing the flood line up to dam No. 1, and so noted on the map. The flood of 1904, as its extreme is given, has much greater volume than the flood of 1892; but the elevation at that point crossed, and so it was continued up to dam number 1.

1465 The line "H. W. 1892" from the E. J. & E. railroad bridge north to Adam's dam, was determined by the engineers of the Sanitary District from actual flood marks and by actual leveling. H. W. 1894 from Adams' dam to dam number 1 was determined from the survey of the Board of Engineers which reported in 1905.

I am familiar with the present physical conditions of the Desplaines river from dam No. 1 at Joliet to the mouth. I am familiar with the slopes, with the volumes of water and the velocities of the water at various points.

This table which is now shown me is something that I have prepared by myself and my assistants. It is entitled: "Slopes in Characteristic Reaches of the Desplaines river, Joliet to the Mouth." I supervised the work of my assistants.

1466 *Cross-Examination.*

The table is not made up from observations of the river made by myself. It is made up from the profile already in evidence of the low water line of 1883, and the profile of 1901 which accompanies the report of the Board of Engineers which reported in 1905, H. R. 263.

Mr. Scott. Further objection—no proper foundation laid for its introduction, or testimony of witness as to accuracy.

Direct Examination Continued.

Q. Have you checked up this table with the data contained in the report of the Board of Engineers for 1905 House Report, 263, so that you are ready to swear that that is correct and accurate.

(Objected to as incompetent, immaterial and irrelevant, and no proper foundation laid for its introduction or for the testimony of the witness in regard to its accuracy; and on the further ground that it does not purport to be and is not made up from all the available evidence necessary to arrive at an accurate conclusion.

A. I have.

Q. Have you checked up?

A. I have.

1467 Q. Now, you may tell where the steepest slopes in the route of the Desplaines river are between dam No. 1 at Joliet and the mouth of the river.

(Objected to as incompetent, irrelevant and immaterial, and no proper foundation has been laid.)

A. The steepest slopes lie between dam No. 1 at Joliet opposite Treat's Island and immediately above the mouth of the Desplaines river.

Q. Is there a slope near dam No. 1 near Joliet?

Counsel for Defendant. Let it be understood that all this goes in subject to objection. I assume that he is testifying from this table, is he not?

Counsel for Government. Not necessarily.

COUNSEL FOR DEFENDANT. Then I object on the ground it does not appear what source of information he is testifying from, and I will ask him whether or not his testimony is from this table.

The WITNESS. From the table and the profiles together, of which the table is an expression.

COUNSEL FOR GOVERNMENT. Then let your objection stand to all this without repeating it, if you wish.

COUNSEL FOR DEFENDANT. Yes.

Mr. COOLEY. The table is nothing but an expression of the profile.

1468 Take the stretch of the river lying adjacent to dam No. 1 at Joliet, that slope extends down to the head of Lake Joliet, a distance of about 3 miles. A slope of 20.84 feet, I think, is the correct figure. That would be an average slope of less than seven feet to the mile. At Treat's Island we have another slope of 9.55 feet in about one and a quarter miles. That would be at the rate of seven feet to the mile. Near the mouth of the river we have a slope of 4.3 feet in about six-tenths of a mile. That would be at the rate of 7 feet per mile. We have a total fall between dam No. 1 at Joliet and the mouth of the river of 38.73 feet in a distance of 1572 miles. That is at the rate of two feet and 4/10 feet per mile.

1469 From the head of Lake Joliet to the mouth of the river the fall is about 18 feet, in a distance of 12.72 miles, an average of 1.4 feet per mile. The length of Lake Joliet is about 6 miles. The slope of Lake Joliet is about two-tenths of a foot for six miles, or between three and four hundredths of a foot per mile. The fall near Jackson Creek at the foot of Treat's Island is about a mile and a tenth long, as I remember it, and with a fall of about six-tenths of a foot.

1470 The length of Lake Du Page is about 3 miles, with a slope of about one-tenth of a foot in its length or between three and four hundredths per mile.

The blue band on this map between 4,000 and 6,000 feet shows the actual conditions as they exist to-day. This table shows the condition expressed by the low water profile of 1901 as reported by the Board of Engineers in 1905.

If the table shows a total fall from dam No. 1 at Joliet to the mouth of the river of 40.9 feet, that would be correct.

If the table shows a fall from dam No. 1 at Joliet to the

head of Lake Joliet of 22.3 feet, a distance of three miles, that would be correct.

1471 If the table shows a fall from Treat's Island in a distance of a mile and a quarter, of 9.7 feet, or at the rate of 7.62 feet, that would be correct.

If the table shows a fall at the mouth of the river of 4.5 feet in a distance of six-tenths of a mile, that would be correct.

If the table shows a fall in Lake Joliet of five-tenths of a foot in six miles, that would be correct.

If the table shows a fall in the pool below Treat's Island of one-tenth of a foot in a mile and a tenth, that would be correct.

If the table shows a fall in Lake Du Page of three miles long, of four-tenths of a foot, that would be correct.

Whereupon, counsel for the government asked to have this table marked Cooley Exhibit 4, and copied into the record.

Whereupon, counsel for the defendant stated that it was subject to the same objection that was made in the testimony in regard to it.

Whereupon, said document was offered in evidence and marked "Cooley Exhibit No. 4," and is in the words and figures following to wit:

1472 SLOPES IN CHARACTERISTIC REACHES OF DESPLAINES RIVER.

JOLIET TO THE MOUTH.

LOCATION	Dist. bet. points, Feet.	Stat'n of the Profile	Low Water below Chicago Datum. 1883	1901	Fall in Feet between Stations. 1883	1901	Slope, Feet per Mile 1883	1901
Dam No. 1, Joliet.....	.....	14,200	55.90	52.04	.....	.....	.....	.....
		(2.6 Miles from San. Dist. Power Sta.)						
Hickory Creek	9,800	24,000	68.00	67.34	12.10	15.30	6.51	8.24
Brandon Bridge	4,000	28,000	75.30	73.54	7.30	6.20	9.63	8.38
Head of Lake, Joliet	2,000	30,000	76.74	74.34	1.44	.80	3.80	2.11
Foot of Lake, Joliet ...	28,200	58,200	76.94	74.84	.20	.50	0.038	0.094
		(Head of Treat's Island).						
Foot of Rapids.....	6,720	64,920	86.49	84.54	9.55	9.70	7.66	7.62
		(Foot of Treat's Island, 920 above.)						
Jackson Creek	5,480	70,400	87.10	84.64	.61	.10	0.587	0.096
Head of Lake Pupage ..	8,333	78,733	90.24	88.04	3.14	3.40	1.99	2.15
Foot of Lake Dupage ..	5,027*	93,760	90.34	88.44	.10	.40	0.035	0.14
Confluence with Kankakee River	3,440	97,200	94.63	92.94	4.29	4.50	6.58	6.90
Totals	83,000	15.72 Miles			38.73	40.90		

*On record page 1659 Witness Cooley stated in reference to the figures 5027 "that is a typographical error; it should be 15027 feet." Whereupon counsel for the government asked leave to make the correction when the table was originally introduced so as to make it read 15,027 feet.

1473 Mr. COOLEY continues: I am familiar with the report of the survey for the 14 foot waterway from Lockport, Illinois, by way of the Desplaines and Illinois rivers to the mouth of said river which is otherwise known as House Report, Document No. 263.

Q. What is the nature of the improvement recommended by that report?

(Objected to; the report speaks for itself.)

COUNSEL FOR GOVERNMENT. I will state in answer to the objection that this is for the purpose of saving the record. If there is any question as to this, we will be glad to introduce the report or so much of it as may be necessary to meet the objection.

A. The report sets forth its project, the same being for a waterway 14 feet deep, and proposes a canal from dam No.

1 to the head of Lake Joliet and the canal at Marseilles, but otherwise treats the river by a series of falling dams or movable dams known as the Chanoine wicket type, said dams being removed at times when the stages of water are sufficient to produce navigation without their aid; and when the water is low, said dams are restored to position and a series of pools formed, the passage of the dam being effected by a lock, the intention being to form an open river navigation at all
1474 seasons of the year when there is sufficient water in the river to produce it.

This report recommends the use of the Desplaines river itself for the means of this 14-foot waterway, below the head of Lake Joliet.

Whereupon counsel for the government asked if he still pressed his objection.

Counsel for the defendant answered, "Yes, I do."

Whereupon counsel for the government asked the reporter to copy into the record the following, reading from page 16 of House Document, No. 263:

"Between Lockport and Utica, 5 miles above La Salle, the fall of the water surface is about 136 feet in a distance of 63.5 miles, while between Utica and Grafton the fall is but 33 feet in a distance of 229.5 miles (see profile sketch hereto attached). The method of improvement for the former must be by locks and dams. In general terms two routes are available, viz.: the river route and that of the old Illinois and Michigan Canal. The board decided to adopt the river route because the greater width would afford better facilities for navigation, and because subsequent enlargement could be executed at less cost and without interfering with navigation; also because a waterway by that route could be constructed at less cost in the first instance and the annual charges for maintenance would be less. In reaching this conclusion a careful investigation was made of the veloci-
1475 ties to be expected at the higher stages in various parts of the reach. It would found that they would be prohibitive only at Marseilles and at Joliet. At each of these places a canal about 3 miles long is proposed. At several other places for short distances velocities of 3.5 to 4 miles per hour may be expected, but, although somewhat obstructive, these are not prohibitive, and as the floods which cause them are of short duration and occur

only at rare intervals the inconvenience is believed to be of small importance."

Counsel for the government also offered in evidence the table of mean velocities of current in the upper Illinois and lower Desplaines river during extreme high water, which appears on page 41 of this House Document, No. 263, and also the two paragraphs following said table, which table and the two paragraphs so offered are as follows:

1476 MEAN VELOCITIES OF CURRENT IN UPPER ILLINOIS AND LOWER DESPLAINES RIVERS DURING EXTREME HIGH WATER.

Location	Miles from Grafton	Year	Elevation	Area of cross section (square feet)	Discharge (cubic feet per second)	Mean velocity		Remarks
						Feet per second	Miles per hour	
Utica highway bridge	229.7	1892	468.4	17,014	70,952	4.17	2.8	Discharge does not include bottom overflow.
Ottawa highway bridge	239.3	1892	475.3	16,307	85,000	5.21	3.6	
Foot of Moore's Island	242.0	1892	476.6	13,784	71,300	5.17	3.5	Do.
3.6 miles below Marseilles dam	243.4	1892	477.3	11,900	75,000	6.30	4.3	Three-fourths mile below Bell's Island.
2¼ miles below Marseilles dam	244.7	1892	479.3	11,784	75,000	6.36	4.3	One-fourth mile above Bell's Island.
1 mile below Marseilles dam	246.0	1892	483.4	10,312	75,000	7.27	5.0	
¼ Mile above Marseilles dam	247.5	1892	493.5	14,736	74,500	5.06	3.5	Foot of Ballard's Island.

1477

Location	Miles from Grafton	Year	Elevation	Area of cross section (square feet)	Discharge (cubic feet per second)	Mean velocity: Feet per second	Mean velocity: Miles per hour	Remarks
1¼ miles above Marseilles dam	248.5	1892	495.1	12,320	74,500	6.05	4.1	One-fourth mile above Ballard's Island.
3½ miles above Marseilles dam	250.5	1892	497.9	12,736	74,500	5.85	4.0	2 miles above Ballard's Island.
700 feet below Seneca highway bridge	252.6	1892	502.3	13,552	74,000	5.46	3.7	
Morris highway bridge	263.3	1892	507.6	16,079	49,116	3.06	2.1	Discharge does not include bottom overflow.
1 mile below mouth of Kankakee River	271.9	1892	510.1	16,080	73,730	4.50	3.1	
Kankakee Cut-off	274.9	1904	511.1	7,856	28,700	3.65	2.5	
¼ mile below foot of Treat's Island	278.9	1904	513.6	6,976	22,000	3.15	2.1	

1478

1¼ miles below Brandon bridge	284.1	1904	517.6	6,608	22,000	3.33	2.3	
Jefferson Street Bridge, Joliet	287.9	1904	533.6	2,016	22,000	10.91	7.4	

This table is designed to show the greatest velocities which occur from Utica to Joliet. A study of the table, in conjunction with the profile, indicates that from Utica to the foot of Moores Lsland, a distance of 12.3 miles, the maximum velocity varies from 2.8 to 3.6 miles per hour. From the foot of Moores Island to the middle of Bells Island, a distance of 2.3 miles, the velocity increases to 4.3 miles per hour. From this point upstream the velocity continues to increase as we approach the Marseilles dam, which is 247 miles from Grafton. One mile below the dam the velocity was 5 miles per hour. Just below the dam it has been impossible to compute the velocity, as there is not sufficient data on hand, but it was

probably not less than 7 miles per hour. From the Mar-
1479 seilles dam to Seneca, a distance of 4.4 miles, the velocity varies from 3.5 to 4.1 miles, the greater value being found at only one section. From Seneca to Patterson Island, at the head of Lake Joliet, a distance of 32.7 miles, the maximum velocities vary from 2.1 to 3.1 miles per hour. There are two exceptions to this, viz: at the mouth of the Desplaines river and at Treat's Island, where it is impossible to compute the velocity, as there are not sufficient data on hand. It would probably not exceed 4 miles per hour, at either place, for a distance of about one-half mile. Proceeding upstream from Lake Joliet the velocity increases up to dam No. 1 at Joliet. At the Jefferson street bridge the computed velocity is 7.4 miles per hour for the flood of 1904.

"From the preceding investigation it has been decided that the velocities, which obtain during extreme high water, are prohibitive only below the Marseilles and Joliet dams. Under the adopted project a canal about 3 miles long has been provided along each of these sections. The velocity from the Marseilles dam to Seneca, viz.: 3.5 to 4.1 miles per hour, is obstructive to navigation, but not prohibitive, and as these floods occur only at rare intervals and are of short duration, it is not considered necessary to leave the river bed at this section. The same remarks apply to the section just below the proposed canal at Marseilles, and to the short sections at the mouth of the Kankakee River and at Treat's Island."

1479a Mr. Cressy. Q. I will ask you, Mr. Cooley, if these velocities as given on these pages and in what I have read to you, represent the normal velocities in the Desplaines river?

1480 Counsel for defendant. That is objected to as calling for the conclusion of the witness upon data which is not referred to in the question and which does not appear in the record, and because it calls for the blending of various data showing the conditions of the river at times prior to its alteration, with observations made since those various alterations.

A. They do not. They are set forth as the maximum velocities of the flood of 1904, and at all other stages the velocities would be less. So that the normal flow, basing your answer upon this table as to the maximum high water, would be considerably below that.

I am familiar with the depths of the Desplaines river. To ascertain the depths I have examined all the charts and profiles that have been made since the survey of the river has been made, or since 1858. There have been some ten surveys, I believe, reports and projects.

Q. You may state now what are the shallowest points in the river?

(Same objection; no proper foundation laid therefor.)

1481 Q. Can you name, Mr. Cooley, the various soundings that have been made of the Desplaines river?

A. There was a complete set of soundings made in 1883, which was the basis of the Benyard maps and profiles and also of the Marshall map and profile which was reported in 1890, and of which the results are exhibited on profile No. 3. There was also complete soundings made of the river by the Barlow survey in 1899, which soundings are the basis of the maps and profiles submitted by the Board of Engineers in their report submitted in 1905, H. R. 263. Those are the two complete examinations giving the depths in detail and the water line, that of 1883 and that of 1899, upon which the official reports from 1883 to date have been based.

Q. Having in mind those official reports, Mr. Cooley, for the purpose of abbreviating the record in this case I will ask you to state what are the shallowest points in the river between dam No. 1 and its mouth or confluence with the Kankakee.

(Same objection.)

1482 Whereupon counsel for the government stated that the question does not relate to its condition in a state of nature and does relate to the changes made by the turning in of the Sanitary District water.

The WITNESS. A. The first one does not, in 1883.

Q. Are you able to state to-day, without consulting these profiles which you have mentioned, and various soundings as to what are to-day the shallowest points in the Desplaines river, limiting your answer to the present conditions?

(Objected to as being based upon data not identified by the question, nor is it shown or introduced in evidence this case, and as calling for an answer without indicating the source of the information that the witness is expected to give; and generally that no proper foundation has been laid for the question; and on the further ground that the question calls for conditions existing since the

1483 artificial alteration of the river and does not relate to its condition in a state of nature.

A. The shallowest points are opposite the head of Treat's Island at Station 59 as shown on Exhibit No. 3; at Station 64 near the foot of said island; and at Station 96 plus three hundred near the mouth of the river.

1484 Q. Mr. Cooley, referring to the floods of 1881, 1887 and 1892, that you have already spoken about, how do these floods differ from what would have existed prior to the several interferences and changes which you have testified to?

(Objected to as calling for a conclusion of the witness from data not referred to or defined, and as incompetent, immaterial and irrelevant.)

COUNSEL FOR THE GOVERNMENT. In answer to the objection I will ask you, Mr. Cooley, as to whether from the bench marks and monuments, topography and other physical conditions that you have investigated, you are able to answer this question?

A. I am.

Q. Please answer the question.

1485 (Same objection.)

A. The three floods referred to at Joliet has been measured by me and two of them went on top of the structures.

The structures that I refer to are the Illinois and Michigan Canal at that point, the locks. These structures originally were built so as to accommodate the floods that passed Joliet and may be presumed to represent all the knowledge in regard to floods that existed up to that time that the Illinois & Michigan Canal was completed. Some of the accentuations of the floods at Joliet may have been due to the increase in floods due to inhabitation, but the agreement is so close that we may assume that the floods there are substantially the same as existed prior to the construction of the Illinois & Michigan Canal.

Furthermore, the profie of the flood of 1892 as it passes out over portage swamp for the first two or three miles shows a grade line or a flood line which is very flat and does not differ greatly from the flood line that must have existed prior to the changes that were made in the Mud Lake region; it does

1486 not seem to have accentuated that part of the slope in the Mud Lake region, particularly as the floods came toward Chicago. From these circumstances I judge that the flood relation has not substantially changed or did not sub-

stantially change up to the time that the Sanitary District radically altered the conditions in the Desplaines river valley in 1893 and 1894.

I am familiar with the Mud Lake region and the outlet, the outlets that have been made there to the Chicago river, and have rowed out the Ogden ditch as far as the range line which cuts down to lake level to the same line. In the flood of 1892 I went up the Chicago river in a tug through the lumber district and found the waters entirely above the docks in the vicinity of Bridgeport, and everything afloat.

This flood actually rose at Hoyne avenue to a level 8.1 feet above Chicago datum. I caused this flood to be carefully run out from actual flood marks from Hoyne avenue, one block west of Robey street, to Lake Joliet. During the flood I took a skiff at Romeo with a companion and went down the declivities of the Desplaines river as far as Lockport, rowing the skiff myself and only finding my course by looking
1487 around occasionally as a man does when he is rowing.

I made this trip without a particle of difficulty and would have undertaken to have rowed that skiff up against the current, right up to Romeo.

Counsel for defendant moves to strike out what the witness would have undertaken to do.

The WITNESS. In other words, the currents were not such as made it unfeasible to row back.

Q. Could you have rowed that skiff up, back against the current?

(Objected to as incompetent, irrelevant and immaterial.)

A. I could.

Q. Judging by the conditions that you found there in going down, Mr. Cooley?

(Same objection.)

A. I could.

The slope for the first mile and a half or two miles down to Fitzpatrick mound is about half to two-thirds that of the average slope down to Lake Joliet, but from that point down to Lockport the slope is steep, seven to eight feet to the mile.

1488 Now, referring to the Chicago divide, Mr. Cooley, and basing your answer upon the topographical conditions and the investigation which you say you have made of the Mud Lake region, I will ask you how high the floods would

have been in a state of nature crossing that divide before the conditions were changed?

(Objected to as asking the conclusion of the witness upon a matter as to which there is no data in the evidence and no data referred to in the question, and that no proper foundation has been laid, and as incompetent, irrelevant and immaterial.)

The flood of 1892 rose at Summit to a level of 4.27 above the crest of the Ogden-Wentworth dam at the range line R. 12, 13 E., or 16 feet above Chicago datum, and I take it that this flood was a characteristic flood, and that a characteristic volume in great floods would be about 8,000 second feet going east.

The width of this flood at the range line was about three-quarters of a mile. The conditions throughout the Mud Lake region are such that we can presume about on a uniform declivity there, from there to the original divide, five miles or more, eastward, in a state of nature. At the original divide the width of overflow would be in the vicinity of a mile and a half or about double that existing at Summit. The
1489 outlet conditions or the discharging conditions from the original divide are similar in a general way to those behind the divide at Ogden dam, so that we can use the elevation across the later divides to give an approximate elevation on the original divide, and making that comparison the height on the original divide was about five-eighths of that which went over the Ogden dam; or, in other words, the flood rose at the original divide to a level of about 13.7 feet.

This general deduction is confirmed by the fact that the flood of 1892 prolonged toward the original divide would have gone over the original divide at an elevation of about 14 feet or within about 3/10 of a foot of the results which I have given.

There is a further criterion by which the elevation of this flood can be judged, and that is the actual elevation of the flood of 1892 at Hoyne avenue, one block west of Robey street. This flood reached 8.1 feet above Chicago datum at a distance of six miles from Lake Michigan. The Chicago River has been widened and deepened and developed for a harbor of Chicago; in other words, very materially changed from the natural conditions, having a very much greater capacity for the carrying of floods towards Lake Michigan, and it is a

very conservative estimate to assume that the flood at
1490 Hoyne avenue would have been three to four feet higher in a condition of mature. In other words, the level which the flood would run in a condition of nature would be a foot more or less above the actual level of the Chicago divide, and it is nearly a mile and a half to the east of the Chicago divide.

Carrying back that flood slope to the level of the divide would bring us in the vicinity of 14 feet, or even higher. So that we have three methods of approaching this estimate, which all give the results between 13½ and 14 feet, and I have taken, therefore, that elevation conservatively as I believe, at 13½ feet.

The actual elevation of the flood of 1892 at Summit was 16 feet; that would be 4.27 feet greater than the level of the Ogden dam. The Ogden dam being as a matter of fact at the elevation of the natural banks in the vicinity.

In connection with my duties for the Sanitary District and other committees for which I was working, I have investigated and ascertained the actual distances of the various points along the portage route and the Desplaines river. The dis-
1491 tance from Lake Michigan to Ashland avenue is 5.5 miles.

Ashland avenue is substantially at the forks of the south branch and is distant from the Desplaines river by the old water trail 8.3 miles. That is, from Ashland avenue to the Ogden dam or the range line. The distance from the forks of the Chicago river, namely, the junction of the south and west forks, to the Ogden dam is 8.3 miles. The distance from the two forks of the Chicago river to Western avenue is 1.1 miles. The distance from Western avenue to the point that I have put on the map as the original Continental divide is 8/10 of a mile. The total distance from Lake Michigan by way of the Chicago river and the west fork of the south branch of the Chicago divide is 7.5 miles. The distance from the Continental divide to the Ogden-Wentworth dam is 6.3
1492 miles. The total distance from Lake Michigan by the Chicago river, the west fork and Mud Lake is 13.8 miles. The distance from the Ogden dam to the rock escarpment which I said was the end of the 12-mile level is 13.7 miles. The distance of the rock escarpment from Lake Michigan by the water trail without mentioning it in detail is 27.5. The distance from this rock escarpment to Isle la Cache or Romeo Road is 6.7 miles. The total distance from Chicago by the water trail is 34.2 miles. The total distance from Isle la Cache to

dam number 1 at Joliet by way of the Desplaines river is 8.4 miles. And the total distance to dam No. 1 from Lake Michigan by this water trail would be 42.6 miles. The distance from dam No. 1 at Joliet to the head of Lake Joliet would be 3 miles; that would be a total distance of 45.6 miles

1493 The distance from the head of Lake Joliet to the mouth of the Desplaines river is 12.72 miles. And the total distance from Lake Michigan to the mouth of the Desplaines river is 58.32 miles.

I have had occasion in my practice to compute the displacement of boats, the size of boats, and make arrangements for the manufacture of boats, suitable to carry a given amount and navigate on a given depth of water.

I have given a great deal of study to different classes of boats adapted to different waterways as part of my engineering practice. I also built a fleet of boats for the improvement of the Missouri river, or used in the improvement of the Missouri river, at Nebraska City, also at St. Charles, Missouri. I also designed and prepared the specifications and supervised the contract for a fleet of boats for the Missouri, estimated at $555,000 worth, a floating plant of various kinds, including the machinery.

Q. What size boats could be constructed so as to

1494 carry six or eight ton burdens and yet navigate on what you have testified was the original condition in the Desplaines river as to depth of water.

(Objected to as incompetent, irrelevant and immaterial, and calling for the conclusion of the witness, and on the further ground that no proper foundation has been laid.)

A. A boat 8 feet wide and 32 feet long with a depth of about 30 inches, sheer, 6 to 8 inches fore and aft, a maximum—loaded draft of 20 inches and a block coefficient of 85 would displace about 11.3 tons.

This boat stoutly built together with its crew of six men and their belongings, and supplies amounting to eight or nine hundred pounds, would draw about six inches light. It would carry in addition thereto a cargo of eight tons on a draft of 20 inches. It would carry five tons on a draft of 15 inches and it would carry 3 1/3 tons on a draft of 12 inches.

Referring to your profile, Cooley Exhibit 3 on which is shown a low water line of 1883, that line was determined in

the Benyard survey and a number of gauges were set up between Joliet and the mouth of the river which were read during the period at which the survey was made, and
1495 the lowest reading for the season on these several gauges was connected up and reduced by a line of levels and referred to the datum used in that survey, and that is the low water line of 1883.

This low water line has been used in all official reports since as a standard low water, by Captain Marshall in his survey of 1889, reported in 1890; by the Barlow Board, in their survey of 1899; and by the Ernst Board reported in 1905. The Ernst Board also makes use of the low water line of 1901, which they established.

The low water line of 1883 represents the stage of water at low water prior to the turning in of the Sanitary water in 1900. I mean by low water the low water below which the river has seldom gone. It is not an extreme low water and yet much below a usual low water, but it does not represent the habitual stage of the river.

Q. How would the habitual stage of the river correspond with this low water line during these years?

(Objected to on the ground that the question calls
1496 for an answer of the witness as to the condition of the river not in a state of nature but as effected by critical alterations and by the increase of flood due to artificial work, and further, that it is incompetent, immaterial and irrelevant.)

A. The average volume of the stream would lie at a much higher elevation. This is a limit, the lowest limit for the water rather than the common stage of the water.

Q. How would this low water line of 1883 correspond with the condition of the low water line of the river in a state of nature?

(Objected to on the ground that no proper foundation has been laid, that it calls for a conclusion of the witness on a matter as to which there is no data in the record and no data referred to in the question.)

A. We have no profile of the river in an absolute state of nature. We have the profile of 1874 made in the Macomb survey which has not been referred to the same datum as that of 1883 and has not been used in any comparisons that I know of, but does represent conditions similar to those of 1883; or, in other words, is the data after the deepening of

the Illinois and Michigan Canal, which opened in 1871. We have also a profile which is the first profile of record which is reported by General Wilson in 1867, and this profile is the Preston profile made in 1858 by John B. Preston, and represents a condition of extreme and extraordinary low
1497 water, due to the depletion of the water by the Illinois and Michigan Canal.

Can you state, Mr. Cooley, what was the minimum depth, according to the low water of 1883, on the shoals at the head of Treat's Island, if so do so?

(Objected to on the ground that it refers to a condition of the river not in a state of nature, but as affected by artificial alteration; that no proper foundation has been laid, and that there is no data in the question or in the record upon which an answer can be based; and as incompetent, immaterial and irrelevant.)

A. At Station 59 on Cooley Exhibit No. 3 is the shallowest point or shoalest point at the head of Treat's Island, and the depth is 2.6 feet below the low water of 1883. The depth is 2.2 feet at Station No. 64. The depth near the mouth of the river is 1.25 at Station 96.3.

1498 Q. Are you able to state basing your answer upon the report of the Ernst Board of 1905, what was the low water of 1901 at these three points?

(Same objection.)

Counsel for the government for the purpose of saving the record here offered the testimony of the witness, and counsel for the defendant has a right to cross-examine and show that the report shows to the contrary.

A. The depth at the head of Treat's Island at Station 59, as before, 3.7 feet below the low water line of 1901; at the foot of Treat's Island, at Station 64, 3.3 feet; and near the mouth of the river at Station 96.3, 2.9 feet. It has not been precisely ascertained at what flow of the river is the low water of 1901 computed, but it has been usually taken at 4,000 to 4,400 feet.

1499 Q. Is that the normal flow in the Desplaines river today?

(Objected to as calling for testimony as to conditions existing at this time and not in a state of nature; and that no proper foundation has been laid.)

I have investigated to ascertain what is the present flow in the Desplaines river. I have made an investigation of the

tabular statements of the Sanitary District which give the flow in the Desplaines river at Joliet from the records.

Q. Basing your answer upon such examination what would you say is the normal flow of the Desplaines river today?

(Objected to as the conclusion of the witness as to the meaning of records, reports or data which are not offered in evidence, which are not part of the record, and the contents of which do not appear in the question; and on the ground that no proper foundation has been laid; that the testimony is hearsay, and is incompetent, immaterial and irrelevant; and also on the further ground that it relates to the condition of the river as it exists at the present time and not in a state of nature.)

1500 A. I have made personal examinations of it, although I have made no measurements other than to judge by what the volume probably was; and I have accepted the statements given in these tables as the correct statements in regard to the flow of the stream.

Q. Assuming, Mr. Cooley, a flow of 5,000 second feet, you may state what would be the depth at the shallow points you have mentioned, to wit, at the head of Treat's Island, at the foot of Treat's Island and near the mouth of the river?

(Objected to on the grounds that it asks as to conditions existing now and not in a state of nature, and because it asks the opinion of the witness upon an assumption as to a matter which is determinable directly and without any hypothesis, or without any assumption, an existing physical fact.)

A. The depth shown on Cooley Exhibit No. 3 from the
1501 middle of the blue band is as follows: At the head of Treat's Island, Station 59.4 feet; at the foot of Treat's Island, Station 64, 4.3 feet near the mouth of the river at Station 96.3, 3.7 feet.

I have examined the physical conditions of the bed of the Desplaines river at these three points.

Q. How great a distance would the depths that you have given, for the low water of 1883, 1901 and for a flow of 5,000 second feet extend in distance up or down the river?

(Same objection.)

A. It would be extremely short, only a very emall proportion of the length of the river.

The statement 5,000 second feet means 5,000 cubic
1502 feet of water per second and in this case refers to the normal flow of the drainage canal plus the ordinary flow of the Desplaines river.

1502 Q. Could these shallow points, the points, namely, at the head of Treat's Island, at the foot of Treat's Island and near the mouth of the river, be modified or deepened at a small expense.

Mr. Scott. Objected to as leading, and incompetent, immaterial, and irrelevant.

A. These depths could be improved at very moderate cost.

Q. What depth could you obtain at these points, on a flow of 5,000 second feet, provided you made the improvement you refer to?

Mr. Scott. Objected to as leading, incompetent and immaterial, and because the improvements have not been defined; there is no data in the record from which it can be determined what sort of improvement is in the mind of the witness in giving any answer to the question asked; and further on the ground that the question material to this case is only what was the character of the river in its natural condition.

Counsel for Government. In reply to the objection of counsel for the defendant I will say that the issues in this case are defined by the pleadings and not by the objection of counsel; and we object to a statement of counsel as to what are the issues in the case.

1503 Q. Now, Mr. Cooley, you may state in answer to the objection of counsel what would be the improvements and as to whether you have had any experience in the matter of improving rivers to secure a certain depth or not?

(Objected to as incompetent, immaterial and irrelevant.)

A. The work is along the lines of my professional experience and the improvement herein referred to is of very limited character indeed and consists of clearing out the channel and deepening it for very short distances at these particular points. The general depth of the river and the depth above and below these points being ample for the depth which I am to give. With such improvements the depth would be 4½ feet throughout.

I know what is the nature of the bottom of the river at

these points, it consists of boulders and indurated material and of rock, in one instance. With these slight improvements at these three points the river could be
1504 improved so as to secure a depth of 4.5 feet throughout its length from dam number 1 to the mouth of the river; and in making that statement I have in mind an open channel without locks or dams.

Q. Now, assuming, Mr. Cooley, that at some future time we had a flow of 10,000 second feet, what would be the depth of the river at these points?

(Objected to as incompetent and immaterial and asking the opinion of the witness as to conditions which may never exist and which there is nothing to indicate ever will exist, and generally as being incompetent, immaterial and irrelevant.)

COUNSEL FOR GOVERNMENT. I will ask you, is a civil engineer able to compute from data in his possession what would be the depths on such an assumed flow?

A. He can approximately. The same has been computed and is exhibited on Cooley Exhibit Number 3.

On a flow of 10,000 second feet with the same improvements you have referred to, the depth would be six feet. On
1505 a flow of 15,000 feet the depth would be 7 feet and upwards, that being practically the depths which have been several times recommended for the improvement of the Illinois river, and being also the depth for which the Hennepin canal has been built.

(Same objection.)

COUNSEL FOR DEFENDANT. Motion to strike out the voluntary statement of the witness as to "that being practically the depth which has been several times recommended," etc.

I am familiar with the depth of the Hennepin canal. The Hennepin canal was constructed with a depth of 7 feet and in the improvements of the Illinois river up to this time all improvements have preceded on the basis of 7 feet.

I am familiar with the construction of the Sanitary District channel as to the maximum capacity. The maximum capacity of 840,000 cubic feet per minute or 14,000 cubic
1506 feet per second at low water of Lake Michigan, and varying therefrom up to a million feet at high water of Lake Michigan.

Q. Now, in these computations which you have given for 5,000, 10,000 and 15,000 second feet, I will ask you as to whether or not these estimates of a depth of 4½ feet, 6 and 7

feet, respectively, of these shallow places, refer to the minimum depth?

(Objected to as incompetent, irrelevant and immaterial.)

A. They refer to the minimum depth.

Q. Do they or do they not refer to the normal or average depth?

(Same objection.)

A. The normal average depth would be in excess of that.

Q. What would be the condition of the balance of the river with the flow of 5,000, 10,000 or 15,000 second feet?

(Same objection.)

A. The balance of the river would have all the additional depth which exists below the level of these points which have been given and which are extremely limited in length, the depth varying up to ten or fifteen feet in excess of those given for much of the distance.

1506-A I have been over the Desplaines river recently. I am familiar with the whole course of the river so that I am able to state whether there are any dams in the river between dam No. 1 and the mouth of the river.

Q. Are there any dams?

(Objected to as incompetent, irrelevant and immaterial.)

A. There are none.

I am familiar with the rules governing the ascertainment of velocities on declivities.

1507 The velocity is a function of the product of the depth by the slope. In other words, for a given velocity the depth will vary inversely as the slope. Assume that we have a depth of two feet and a slope of seven feet per mile, the velocity under those circumstances will be precisely the same, other things being equal, as though the depth were seven feet and the slope two feet per mile. We will assume a condition such as approximates a flood condition, where the depth is five feet and the slope seven feet per mile; the velocity produced by that condition would be the same as a stream which had a general depth of forty feet and a slope of ten inches to the mile, for instance.

In other words, the velocity produced by that slope and depth would be identical with that existing in the Missouri river at the bank full stage. Again, take a stream that has about 4/10 of a foot per mile slope, and a depth of 80 feet or

more, as in the Mississippi river between Cairo and Memphis at bank full stage, the velocity there existing would be identical with that on a slope of seven feet per mile and a depth of five feet, assuming the same coefficient. As a matter of fact, both in the Missouri and in the Mississippi rivers the coefficients would be higher and the velocities would be higher than would obtain in a stream such as I have assumed.

1508 COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive to the question.

I am familiar with the width of the Desplaines river at its various points as they exist today.

Q. What is its width or various widths?

(Objected to as incompetent, immaterial and irrelevant, and calling for the condition of the river as it is today and not as it was in a state of nature, and as not the best evidence, there being maps in evidence already introduced by the United States purporting to show those widths.)

The width of the Desplaines river below dam No. 1 at present is 180 to 220 feet down to the vicinity of McDonough street through the City of Joliet and below dam No. 1, and this width is the width as made by improvement and not the natural width of the river. Below McDonough street and down to Lake Joliet the stream has its original and natural width of 300 to 500 feet. Through Lake Joliet it varies from 500 to 900 feet down to Treat's Island. Passing

1509 Treat's Island for a larger portion of the distance it is about 180 feet wide. It varies in width from there down to Lake Du Page about 180 to 200 feet at Smith's bridge, and in that vicinity. Lake Du Page is about an average width of 350 feet for about three miles. Near the mouth of the river it varies from 300 to 250 feet, the lower part as it approaches the confluence being about 250 feet wide. I will say I can give you the natural width of the river up in Joliet, if you wish.

Q. You may do so. What is the natural width of the river up in Joliet?

(Same objection.)

A. The widths I have given below McDonough street are the natural widths; they have never been changed by the works of man. Above McDonough street the original widths were quite variable, from the width now existing down to about 120 or 130 feet at the narrowest points, in the vicinity

of the Rock Island railroad crossing and between there and Exchange street.

1510 I have made several examinations of the Desplaines river since the Sanitary District water was turned in. I am familiar with the present conditions of the Desplaines river, its slopes, its widths, its depth, and the general condition of its currents, and other physical conditions. I have made an examination of the river during 1910.

Q. Now, Mr. Cooley, having in mind your testimony in reference to the present condition of the Desplaines river, its depths, its slopes, its volumes of water, the width of the channel, I will ask you whether or not as an expert engineer you would say that the Desplaines river is today a navigable river from the mouth of the Desplaines river to dam No. 1 at Joliet?

(Objected to as incompetent, irrelevant and immaterial; as calling for a conclusion of the witness upon data which does not appear in the record and which is not indicated in the question; on the further ground that no proper foundation is laid; on the further ground that the issue in the case is not the navigability of the river as it is today.)

A. It is.

1511 Q. For boats drawing how much water, Mr. Cooley?

(Same objection.)

A. Three and a half feet and upwards depending upon the stage of the river.

Q. And with the improvement which you have spoken of at the head of Treat's Island, the foot of Treat's Island, and near the mouth of the river, what would be the depth at which it would be navigable between the points mentioned?

(Same objection.)

A. Four and a half feet and upwards, depending on the stage of the river.

1512 Q. Supposing, Mr. Cooley, that the Sanitary District of Chicago channel were navigable water of the United States, and was actually capable of being navigated down to Dam No. 1 at Joliet by boats drawing nine to ten feet of water; suppose that the great lakes and St. Lawrence system were navigable waters of the United States and Canada; supposing that the Mississippi river was a navigable water of the United States; and that the Illinois river was a navigable water of the United States as far as the mouth of

the Desplaines river, what position does the Desplaines river from dam No. 1 to the mouth of the river occupy in relation to those waters?

(This is objected to as incompetent, immaterial and irrelevant; that the position of the Desplaines river is not to be determined by the testimony of any witness but the physical facts which shall appear concerning it; and on the general ground that it is incompetent, immaterial and irrelevant, and because it assumes facts which do not appear to be facts from the record in this case; and that it refers to data which is not defined or indicated either in the record or in the question.)

A. It is the connecting link between the waterway
1513 system of the great lakes and of the Mississippi valley, and in a water route extending 3,300 miles from the Gulf of Mexico to the Gulf of St. Lawrence.

Q. It represents a distance of how long, Mr. Cooley?

(Objected to as incompetent, immaterial and irrelevant,)

A. 15.72.

Q. Take this 15.72 miles which you state to be the distance from dam No. 1 to the mouth of the river, and state what proportion of that is capable of being navigated today in its present condition by boats of shallow draft and what proportions is capable of being navigated today by boats of deeper draft?

(Same objection.)

Q. Now, Mr. Cooley, you may answer that question, but base your answer upon the testimony and only that testimony which you have introduced into the record here.

1514 (Objected to on the ground that that testimony is not sufficient or competent to afford a basis for the conclusion asked of the witness; and on the further ground that the conclusion of the witness on that testimony is not competent, and that the court cannot be ousted of its function by the expression of an opinion by this witness as to what his testimony proves.)

A. The river between dam No. 1 and the mouth is today capable of navigation for boats of moderate draft and for a depth of three and a half feet and upwards depending upon the state of the water. The river is susceptible of improvement at moderate cost for an increased draft up to four and a half feet or upwards, depending upon the state of the

water. It is susceptible of radical improvement by means of locks and dams and a project has been made for a depth of fourteen feet and upwards, and officially reported at reasonable cost.

COUNSEL FOR DEFENDANT. I move to strike out the volunteered statements of the witness as to the suggestion of reports which have been made as to the possible improvement of the river, as not responsive to the question, and as incompetent.

1515 I have testified as to the total length of the deep water stretches in this 15.72 miles.

Q. What are they?

(Objected to on the ground that there was no occasion to repeat them in the record, and for the same objections previously stated.)

A. These depths are much in excess of the minimum stated for about 60 per cent. of the total length of the stream between dam No. 1 and the mouth; in a total distance of 15.72 miles, a total distance of the deep water of about 10 miles.

Q. Now, Mr. Cooley, if the Desplaines river was improved as recommended by the report of 1905, House Report Number 263, by the construction of a canal around the Marseilles dam and by the construction of a lock in dam number 1, could boats engaged in trade and commerce pass from the Mississippi river system and into the St. Lawrence river system and vice versa?

(Objected to as incompetent, immaterial and irrelevant; and on the further ground that it does not include the features of the proposed improvement in the report of 1905 which are material to the question.)

1516 A. Boats could pass. Trade and commerce are carried on by these improvements would be a profitable one.

I am familiar with the various reports which have been made concernind the improvement of the Desplaines and Illinois rivers. The Desplaines river has been covered in ten distinct surveys, reports and projects, seven of which are official reports of the United States.

Q. How do these reports consider the Desplaines river as susceptible of improvement for the purposes of navigation?

(Objected to as incompetent, immaterial and irrelevant, as the reports speak for themselves, and the con-

clusion of this witness as to them is not competent evidence.)

COUNSEL FOR GOVERNMENT. I will say, before you answer that question, have you read all these reports, Mr. Cooley?

A. I have.

Q. Are you familiar with all the data which they furnish concerning the conditions of the Desplaines river?

A. I am.

1517 Q. Now, you may answer the question.

A. These reports uniformly recommend the improvement of the Desplaines river as the most available way or route for a waterway between the great lakes and the Mississippi river.

Q. Is there anything further, Mr. Cooley, that you care to say in reference to the navigability of the Desplaines river?

(Objected to as incompetent, immaterial and irrelvant.)

A. Nothing further, except that in view of the very large proportion of pool and the great depth that these pools naturally have, and the very small proportion of intermediate river that must be improved or excavated, the stream is eminently fitted to produce a navigation of any depth that is desired between the great lakes and the Mississippi river.

Cross-Examination.

Q. What elevation of the gauge at Riverside would be required in order to produce a depth of 12 inches of water over the original divide?

A. 13.8 to 14 feet.

1518 As to what elevation of the gauge at Riverside would be required to produce six inches in depth of water on the original divide, I would say that this is an intermediate figure that I have not in my mind, but I can give it to you after a little.

The process by which I arrived at the conclusion as to what elevation the gauge at Riverside would be required in order to produce a depth of 12 inches of water on the original divide is the elevation at Summit for a depth of 12 inches on the original divide would be 11.73 to 12 feet, or in that vicinity, and the elevation on the original divide would be 11.5. That is, assuming, that no advantage is to be taken of the trench spoken of by Phillips and Graham, and Long.

But in this answer I am giving it for the original divide without the addition of the trench, and give the elevation at Summit as 11.73 to 12 inches or 12 feet on the original divide. The elevation on the original divide would be lower than that at Summit by the amount of fall through the portage swamp region, which would be the difference in the elevation which I have given at Summit, or 11.5. In other words, from 3 to 6 inches of fall in the original portage swamp for that volume of water.

1519

As to what calculations or answers, made by me, as to condition on the divide, I have taken into account the trench. I would generally assume the trench is six to nine inches in depth and to add that additional water.

Q. Have these depths that you have given as to conditions existing in times of flood included this assumed depth of the trench?

A. At the times when the elevation of the water is above that given at Riverside, 13.8, there would be sufficient water across the divide so that the assumption has not necessarily been made.

COUNSEL FOR DEFENDANT. I move that the answer be stricken out as not responsive to the question, and I ask that the question be again read to the witness. (Question read.)

A. Not in what I call flood stages. I have included this assumed depth of the trench in all moderate stages because the depths are so much in excess of any limitation that we have assumed for the draft of boats that it did not occur to me as involved in any way as limiting the depth over the divide in flood stages.

1520

Q. Then as your evidence stood before this cross-examination, there was no means of determining where you referred to depths over the divide, what answers included the trench and what answers excluded them, was there, or if there was, please state what it was?

A. I do not recall that any questions were asked me in regard to the trench other than the fact that such trench existed.

COUNSEL FOR THE DEFENDANT. I move to strike out the answer as not responsive to the question, and I ask that the question be again read to the witness. (Question read.)

A. I do not know that without reading over the testimony, as to whether such a question was asked or not.

1521

Q. The question did not relate to questions asked; it related to answers given. I would ask you to answer the question in that light.

A. I will answer the question in this way: In estimating the depths on the original divide at moderate stages I considered that those depths would probably be sufficient on the original divide, but in view of some uncertainty as to the exact amount of slope that would prevail in the portage swamp region, the trench was in my mind as a safety factor which would amply cover any discrepancies there were in my statements.

As to whether I know of any place in the record where that safety factor got into the record will say I don't know that it is in the record; I did not frame the questions. I consider that trench is a part of the original divide and always has been since it has been used by boats.

1522 When I speak of the original divide I mean the divide as it was in a state of nature, in its natural condition. The trench was part of its natural condition.

Q. Do you understand that there was a natural trench unaided by any voyagers or early explorers of the depth that you have given here on that divide?

A. Unfortunately we are not able to answer that question. I suspect that there was.

Q. Is it a fair interpretation to say that it did exist?

A. I do not know that it did exist, but that such a depression in that location, would not be a strange thing. It would be quite a natural thing to exist.

I have assumed the depth of the trench from 6 to 9 inches. I base that assumption upon this proposition, that a trench to be noticeable and to be remarked upon would have at least that depth. It may have been more.

1523 That is not the entire basis for my assumption. I have conversed with men who saw the trench as it existed before the divide was cut. As to whether I have conversed with anybody who saw it in a state of nature, I have called a state of nature what existed prior to the changes made in 1852. As to whether that assumes that a trench existed there before the white men used that trail, I would say, I assume that it may have existed there, but there certainly did exist a line of lowest depression; it would be natural for it to exist. Such a trench as is related by Long and referred to by Graham and Phillips was worn out broader and deeper by the attrition of passing boats and by the washings of the currents that passed through it.

The gauge at Riverside is set with reference to Chicago datum. As originally established, it was spiked to a tree,

under my personal supervision, and reached down to low
1524 water in the Desplaines river, or to near low water in the Desplaines river. I think the original gauge at that point did not quite reach low water, and we had to measure down from the lowest mark on it when the water was at extreme low stage. The gauge has been maintained since then, not the original gauge board but the gauge at that locality. I have not seen it personally for some years. I established a discharging station at that point, and as I recall it, it was about 150 or 160 feet wide. I would not say definitely without refreshing my memory. It is not what I call either a hole or a basin. It was set in the back water of a pool.

I have stated my recollection in the matter of the width of that pool, but subject to refreshing my memory, I would say it has a width of about 150 or 160 feet.

Q. What would be the gauge reading at Riverside to produce 13.6 at Summit?

A. I do not know that I can state that offhand, without going over the profiles and refreshing my memory. I
1525 would say, subject to correction, between 17 and 18 feet. As to what elevation of the gauge at Riverside would be required to produce 6 inches in depth of water on the original divide, I would state in the vicinity of 13.5. I mean at the Riverside gauge.

Counsel for the defendant asked leave to defer the further cross-examination of the witness Lyman E. Cooley until he had time to examine his testimony. The witness was therefore excused temporarily.

1526 G. A. M. LILJENCRANTZ, called as a witness on behalf of the Government, testified as follows:

Direct Examination by Mr. Cressy.

My official position is Assistant Engineer, United States Engineer office, in Chicago. I have been connected with
1527 this Chicago District since April, 1871. For a couple of years I was draftsman; since then I have been assistant engineer. I have had work to do, more or less surveying and planning, and so on, Chicago harbor and river, Calumet river and harbor, Michigan City harbor, and lately Indiana Harbor, and then I have made surveys in Rock River for the Hennepin canal, and more or less work for the Illinois river. In my

survey of the Rock River I had to do with the making of the estimates for land that was taken for the use of that river. I am familiar with the government reports which have to do with the estimates of damages for land taken by the United States in the making of improvements for rivers and harbors. At the direction of the United States I have read through and examined closely the reports entitled as follows: "House of Representatives Executive Document Number 16, 40th Congress, First Session, being a survey of the Illinois river, under Major General J. H. Wilson" dated May 13, 1867, which report contains the report of his assistant engineer and is the document now shown me. I have read through and examined closely the report entitled: "Reports upon
1528 Transportation Routes to the seaboard, being Appendix CC. of the annual report of the Chief of Engineers for 1875." That was known as the Macomb report and is the document now shown me. I have read through and examined closely the report of Major Benyaurd in 1882 and 1884. There are two of these reports, 1882 and 1884, and are contained in this volume shown me. I have read through and closely examined, also the report of the Comstock Board made in 1887. That is also contained in this book. I have read through and closely examined the report of W. L. Marshall made in 1890 which is entitled in this pamphlet "House of Represen-
1529 tatives Executive Document 264, 51st Congress, First Session." I have read over and closely examined the report of the Barlow Board as contained in this pamphlet "Annual Report upon the improvement of Chicago and Calumet Harbors and Chicago and Illinois Rivers, Illinois, etc., in charge of J. H. Willard, Major Corps of Engineers, U. S. A. being appendix MM of the Annual Report of the Chief of Engineers for 1901." I have read over and carefully examined the report of the survey with plans and estimates of costs for a "Navigable waterway fourteen feet deep from Lockport, Illinois, by way of the Desplaines and Illinois river to the mouth of said Illinois River," otherwise known as the report of the Ernst Board, which is contained in this document, House of Representatives Document No. 263, 59th Congress, First Session. I have examined and read over the report of Major Wilson, dated October 20th, 1868. I have paid particular attention in my examination as to the question of appropriation of money for the payment of damages caused by the improvements contemplated in those reports and
1530 I found in these reports estimates of such damages.

These are estimated in various reports for use of abut-
1531 ments of dams and for construction of locks, and for lock buildings, and for other buildings that may be expected to be used in connection with the improvements and for overflow of land caused by the building of the dams. I have read over and examined the report of the Chief of Engineers, dated Washington, October 20, 1868, together with the accompanying documents, including the report of Engineer Werrall and the report of Major General Wilson. That report is contained in this document which is now shown me and is the report of the Chief of Engineers to the Secretary of War. It is entitled "House of Representatives, Executive Document 1, part 2, 40th Congress, 3rd Session; message of the President of the United States and the accompanying documents to the two houses of Congress at the commencement of the third session of the 40th Congress."

Q. In these nine reports, which you have read over and examined was any estimate contained in any of them for dam-
ages caused to the riparian owners on the banks of the
1532 Desplaines river for the contemplated use of the Desplaines river in the improvements mentioned in these reports.

(Objected to as incompetent, immaterial and irrelevant and as being hearsay; and on the ground that it is not competent to prove by the witness the contents of the reports. The reports themselves being available.)

A. No, sir.

Q. I will ask you to state as an engineer familiar with the making of estimates for improvements of rivers and harbors as to whether such an estimate would have been contained in those reports if the engineer in charge of the work had considered that the Desplaines river was a navigable river.

(Objected to as incompetent, immaterial and irrelevant and no proper foundation has been laid, and that the reports speak for themselves.

A. If it was considered not a navigable river, then there certainly would have been estimates.

1533 The WITNESS. I have not had anything to do in other
1534 projects with any plan where the river was considered as not navigable.

Q. Have you had to do with the construction of canals and in those cases estimates were furnished in the improvements for the land taken for the canal.

(Objected to as incompetent, immaterial, and irrelevant and no proper foundation has been made.)

A. Yes, sir.

Q. Suppose a river which contained a great many bends was straightened by means of canals made to connect the various points; the improvements to have been made by the United States, would the estimates for the cost of the improvement in such a case have contained estimates for the damage to the owners of the land taken for the improvement.

(Objected to as incompetent, immaterial and irrelevant.)

The WITNESS. I certainly think it would; if you would cross a bend, taking a private party's land they certainly would have been considered and estimated. In the river where they took land for the abutments of the dams or for the construction of the locks that they did make estimates for the appropriation of that land, for the taking of that land for the
1535 public use. In these nine reports I have examined in detail the official estimates of the cost of the proposed plan, and every item contained in them relating to the damages for land above or beyond the water line, or land to be taken for occupancy of proposed structures such as locks, abutments for dams, canals around the rapids, or land damaged by overflow.

Q. In these nine reports was any question raised in any of them or in any part of any of them, or the sub-reports of the engineers which were attached to them, as to the right of the United States to occupy and utilize any part of the river in question between the low water lines for the purpose of improving the stream.

(Objected to as incompetent, immaterial and irrelevant.)

The WITNESS. No.

Q. From your examination of these nine reports as an engineer familiar with the making of public improvements, what would you say as to the standing that the Desplaines river had between its mouth and Joliet, Illinois, as to being a navigable or a non-navigable river?

(Objected to as being incompetent, irrelevant, and immaterial, no proper foundation has been laid; and that the data upon which the witness must answer, if he answer at all, is not included in the question and does not
1536 appear in the record so far as the question shows.

COUNSEL FOR GOVERNMENT. In order that the question may cover the objection of the defendant, I will add to it the following: taking into consideration the data and that

data only which you find in the nine reports to which you have referred and which are now here before you.

COUNSEL FOR DEFENDANT. The same objection stands.

The WITNESS. I should consider that by the officers making the reports they considered the Desplaines river as a navigable river of the United States. I have made a specific examination of these nine reports for the purpose of determining this question.

COUNSEL FOR DEFENDANT. I move to strike out as not responsive.

1537 Q. Have you made an examination of these nine reports for the purpose of finding data bearing upon the question of whether the river was navigable or non-navigable.

(Objected to as leading, incompetent, immaterial and irrelevant.

The WITNESS. Yes, I have.

Q. I will ask you to refer to the reports and read in evidence such passages in those reports as refer to the question of the navigability or the adaptability for navigation, or adaptability for improvement for navigation of the Desplaines river.

(Objected to as incompetent, immaterial and irrele-
1538 vant, and because it calls for extracts on two different propositions; one the navigability of the river and the other the possibility of making it navigable, and that the two things are inconsistent.

The WITNESS. By way of explanation first, before I read the extracts. I have made selections of these extracts from passages that would indicate that the officers making their reports have selected the river bed for use as a portion of the proposed waterway without afterwards having included any estimate of cost for the use of that river bed. I do not suppose I want to take in all of them; I will take in a few. There are so many of them.

1539 (Reading): From General Wilson's report of 1867, on page 6, paragraph 5, it says:

* * * "it must be remembered that this river is not the exclusive property of those living upon its banks. It forms already an important link in a network of river navigation, extending with its various branches, through seventeen States of the Union," * * *.

On page 8, paragraph 3, it says:

* * * "It is quite evident * * * that steamboat navi-

gation can be more cheaply provided between Lockport and La Salle by following the line of the river than by enlarging the canal."

I will skip some of those less important. In General Wilson's report of 1868, it says on page 441, paragraph 1:

* * * "The only practicable route * * * follows the present Illinois and Michigan Canal from Chicago until a point was reached when it would be expedient to improve and occupy the river."

On page 445, paragraph 4:

"The navigation of a canal 160 feet wide and 7 feet deep would be vastly inferior to that of a river from 3 to 5 times as wide and generally of greater depth."

1540 On page 446, the first paragraph:

"After comparing carefully * * * we have no hesitation in recommending the river route from the head of Lake Joliet to the mouth of the river." * * *

From paragraph 4 on the same page:

"As all the water drawn from Lake Michigan and received into Desplaines and Illinois rivers from tributary streams will contribute to their channels for navigation, none of it being lost by filtration, the full depth requisite can be more certainly maintained than in a canal."

From page 447, paragraph 5:

"From the reports and profiles herewith it will be seen that this system of improvement (via river) will submerge but little if any valuable land. The height of the bottom lands above low water in the river, except such as are now low and marshy and inundated by a slight rise of water, is generally not less than from 10 to 15 feet, and in many places from 18 to 20 feet * * *. All such lands, therefore, as would be overflowed by the construction of the dams, would be overflowed now by a slight rise of the river, and cannot consequently be considered very valuable." * * *

(On page 447 next to the last paragraph):

* * * "the change which would be made in the bed of the river by the proposed improvement" * * *

That is merely referred to there.

1541 Page 458:

"The detailed estimate of cost makes no provision for any riparian rights nor for any remuneration for the use of the river bed."

Then we come to Worrall's report. On page 462, paragraph 4:

* * * "Therefore when the stream along which the work passes offers facilities for slackwater improvement, such offer cannot well be rejected as a single work, a single expenditure at one point in this style of improvement creates a navigation extending sometimes over many miles in which no expense is necessary for construction or maintenance."

Now here is the report on transportation routes to the Seaboard. Col. MaComb was the senior officer and this is the report of Col. MaComb dated January 25, 1875; it is page 95, paragraph 3 in the executive document, I think. It is page 525 in the Chief of Engineer's report:

* * * "Upper Illinois river and enlarged canal from Joliet to Chicago, will afford the best route for navigation between the Mississippi river and Lake Michigan that can be secured in this vicinity."

And paragraph 6 on the same page:

* * * "Indeed, the Hennepin Canal, without the improvement of the upper Illinois river and the enlargement of the eastern portion of the Illinois and Michigan Canal, would be useless as an outlet for the freights of the upper Mississippi River."

1542 Then the report of Assistant Engineer F. C. Doran, January 9, 1875, page 96, last paragraph:

* * * "It is believed the proposed plan of enlargement of the Illinois and Michigan Canal, combined with the improvement of the river, and the construction of the Henepin Canal, will, when completed, meet the wants of the commercial world" * * *.

On page 97, paragraph 3, he uses this expression:

* * * "The second division extending from Joliet to La Salle, will consist of an improvement of the river by locks and dams, being virtually a continuation of the slackwater navigation projected in the river below La Salle" * * *.

You see this is an extract. It refers to the first division, I suppose, in the report. You can get that from the report there. I have commenced to quote from that part. (par. 3, p. 97.)

1543 (Reading):

"In view of the fact that different styles of navigation are proposed on different parts of the route, I have

divided it into three divisions. The first division consists of independent canal from Chicago to Joliet; the second division, extending from Joliet to La Salle, will consist of an improvement of the river by locks and dams, being virtually a continuation of the slack-water navigation projected in the river below La Salle. The third division consists of independent canal, corresponding to the line adopted and known as the Hennepin Canal, extending from the Illinois to the Mississippi River." "From a point a short distance above the city of Joliet the Des Plaines River flows in a southwest di-
1544 rection for a distance of sixteen miles; here it unites with the Kankakee coming in from the southeast, and forms the Illinois. The latter follows a course almost directly west to beyond La Salle."

Major Benyaurd's report, dated Septemebr 2, 1882. You have that in the book there. Page 1957, last paragraph:

* * * "The canal runs in close proximity to the river * * * and in making up the estimate for the enlargement of the canal, it will be necessary to discuss whether or not it will be more economical to enlarge the canal between those two points (Joliet and La Salle) or to improve the river and abandon the other."

In Major Benyaurd's report, in 1884, page 1958, paragraph 6:

"It is evident, after consideration, that the only feasible plan to render the stream navigable is to slackwater the whole distance. * * * Certain lowlands will necessarily be submerged * * * very little of it, however, is of any considerable value, and can very easily be estimated for" * * *.

The last paragraph on the same page:

"With the improvement of the river now in question carried on (Illinois river) navigation will be brought to within 33 miles of the Lake and this stretch can be opened
1545 by improving the Des Plaines higher up" &s. * * *

Page 1959, paragraph 2:

* * * "While in case of the larger locks the expense would be greatly in favor of the river route * * * the river route has also the advantage, when it is considered that we have navigation on a stream 600 feet wide instead of the narrow channel of the canal."

And the third paragraph on the same page:

"Looking at the matter in an engineering point of

view, it is difficult to understand what led originally to the construction of the canal, rather than the improvement of the natural channel of the river. Should the Illinois and Michigan Canal be accepted by the Government, and its enlargement undertaken, that part between Joliet and La Salle should be abandoned and the river route between these points adopted."

Page 1963, Assistant Engineer, Geo. Y. Wisner's estimates do not provide for any payments for the use of the river bed.

The next is the Comstock Board, report of Chief of Engineers for 1887, page 2125. This is the Secretary of War to the Speaker of the House, January 10, 1887, page 2125, last paragraph:

* * * "The report of the Board of Engineers shows that to enlarge the canal between Joliet and La Salle, and provide for an increased navigation * * * would re-
1546 quire an expenditure of money greater than the cost of improving the river itself between Joliet and La Salle."

Page 2126, paragraph 3:

"The conclusion, therefore, would seem to be clear that the United States should not be bound to enlarge the existing canal between La Salle and Joliet, if the improvement between those places will furnish a cheaper mode of communication" * * *.

And next there is the report of the Chief of Engineers to the Secretary of War, December 3, 1886, page 2127, paragraph 2:

* * * "I concur in the opinion of the Board regarding the utility and importance to navigation and commerce of a waterway from Chicago to Grafton" * * *.

And page 2128, paragraph 1:

* * * "and since the cost of an enlargement of the canal between these points would, it appears, be greater than that of improving the river itself, the river route between those points (La Salle and Joliet) should be adopted."

That is an extract from the report to the Board.

Page 2129, paragraph 4:

"The waterway from Chicago to Grafton on the Mississippi River is a most important one, and when completed there is little doubt that it will richly pay for itself in the reduction of freights."

Page 2189, paragraph 11:

"Consequently, were the United States in possession of

the canal, it would be judicious to abandon it between La Salle and Joliet in favor of the river."

1547 The next is the report of Captain W. L. Marshall, in Executive Document No. 264, 51st Congress, 1st Session, February 28, 1890, page 2. That is an extract from the River and Harbor Act of August 11, 1888:

* * * "The Sec. of War authorized and directed to cause to be made proper surveys, plans and estimates for a channel improvement and locks and dams in the beds of Illinois and Des Plaines rivers from La Salle to Lockport" * * *.

Page 3, paragraph 3:

"The most practicable routes across the Chicago Divide, and which have been long known and recognized, are two, each of which admits choice of location, the valleys being quite wide.

"(1) By way of the Chicago River and its South Fork, and the present location of the Illinois and Michigan Canal, or Mud Lake and the Ogden Ditch, to the Des Plaines, near Summit, about 12 miles from the City Hall of Chicago, and about 8 miles from Bridgeport; thence via the Des Plaines River Valley, uniting at Sag Bridge with route.

(2) Which is via the Grand and Little Calumet Rivers to Blue Island, thence westward along the old Calumet Feeder Route to the Des Plaines River at Sag Bridge."

Page 5, paragraph 5:

"In the Des Plaines and Illinois Rivers the practical depth of navigation after the construction of this chan-
1548 nel will vary with the stage of the rivers * * * there will be in the river portions of the route from Joliet to La Salle a navigable channel varying in depth from 8 feet, when the discharge of the river is a minimum, to from 10 to 16 feet at mid stages."

Page 6, last paragraph:

"At all stages of water when this class of boats (largest Mississippi River steamboats) can reach the mouth of the Illinois river, they can probably go on through the proposed channel to Lake Michigan as far as depth of water is concerned." * * *

Page 8, paragraph 4:

* * * "The conditions imposed by the act, that it shall occupy the bed of the river" * * *.

Page 12, paragraph 3:

"The route proposed follows the Chicago River * * * thence parallel to the present location of the Illinois and Michigan Canal, on lower ground, 3 miles, more or less, where it enters the bed of the Des Plaines river which it practically follows" * * *.

"The route is preferred to the present location of the Illinois and Michigan Canal, or one adjacent to it."

Page 15, paragraph 1:

* * * "The line then leaves the present canal in a direct line into Lake Joliet, and thence to La Salle occupies the beds of the Des Plaines and Illinois rivers, except at Marseilles, where a short canal is constructed around the rapids at that point" * * *.

Page 15, paragraph 3:

1549 "In the river portion of the route the required depth are obtained by the aid of dams, as far as practicable. The dams are proposed to be as high as admissible, without too great damages by flowage, and the additional depths required are obtained by excavation in the beds of the river" * * *.

"The estimates are not based upon the removal of this material and placing it upon the top of the banks, but simply for removing it from the navigable channel and its deposits within the banks where it will not probably re-enter the excavated channels."

Pages 16 and 17 contain estimates of cost, but without any provisions for payments for riparian rights, nor for the occupation of the river beds.

Page 21, paragraph 3:

"There is, then, no engineering difficulty, or any apparent reason why the constructions proposed, with slight modifications, that would not materially increase the estimates, will not satisfactorily subserve the purpose of a navigable channel as far as to the mouth of the Kankakee."

The next is survey of the upper Illinois and lower Desplaines rivers, authorized by Act of Congress of March 3, 1899:

A Board of three Engineer Officers, Col. J. W. Barlow, Sr. Officer, made reports under dates of March 17, 1900, and November 17, 1900.

The Board appears to have come to the conclusion
1150 that, owing to the change in the low water lines of the rivers, caused by the great increase in the flow of water through the Chicago Sanitary Drainage Canal, the Illinois and Michigan Canal should be enladged and made use of rather than the beds of the Illinois and Des Plaines Rivers, between the mouth of the Kankakee River and Lake Joliet.

"Q. Survey. * * * For a navigable waterway 14 feet deep from Lockport, Ill., by way of Des Plaines and Illinois Rivers, &c., &c."

General Ernst, Sr. Officer. That is Executive Document No. 263, that large volume.

Page 1, Chief of Engineers to the Secretary of War, December 12, 1905. First in an extract from Act of Congress, approved June 13, 1902:

* * * "For making surveys * * * as may be required to determine the feasibility of, and to prepare * * * estimates of cost of a navigable waterway, 14 feet in depth, from Lockport, Ill. by way of Des Plaines and Illinois rivers, to the mouth of said river" * * *.

On page 6, Report of the Board. Gen. O. H. Ernst, Sr. Member.

On page 16, paragraph 3:

* * * "In general terms two routes are available, viz.: the river route and that of the old Illinois and Michigan Canal."

"The Board decided to adopt the river route because
1551 the greater width would afford better facilities for navigation, and because subsequent enlargement could be executed at less cost and without interfering with navigation; also because a waterway by that route could be constructed at less cost in the first instance and the annual charges for maintenance would be less." * * *

"In reaching this conclusion a careful investigation was made of the velocities to be expected at the higher stages in various parts of the reach. It was found that they would be prohibitive only at Marseilles and at Joliet. At each of these places a canal about three miles long is proposed. At several other places for short distances velocities of 3.5 to 4 miles per hour may be expected, but, although some what obstructive, these are not prohibitive, and as the floods which cause them are of short duration and occur only at rare intervals the inconvenience is believed to be of small importance."

Page 17, paragraph 4:

* * * "Including the valley of the Kankakee as well as that of the Desplaines, the amount of land damages is 382 acres."

Page 22, that is from Assistant Engineer Woermann's report, dated August 14, 1905.

Page 39, The River Route versus the Canal Route from Utica to Lockport:

1552 "From Utica to Lockport it is possible to construct a deep waterway either by canalizing the Illinois and Des Plaines Rivers, or by building an overland canal along the line of the old Illinois and Michigan Canal." * * *

Page 40, paragraph 9:

"Navigation would be much more inferior in a canal 160 ft. wide than in an open river 400 to 800 feet wide. The whole river would not be available for boats drawing 12 to 13 feet, but boats of less draft could utilize the entire width over a large portion of the streams."

"From a consideration of the arguments above, it was concluded that the river route is preferable for the following reasons:"

"(1) It is cheaper in first cost."

"(2) It can be maintained at less cost."

"(3) It will afford better navigation on account of its greater width."

"(4) Subsequent enlargement can be executed at less cost and without interfering with navigation."

COUNSEL FOR GOVERNMENT. The government offers in evidence the passages referred to by the witness in these reports, with the request that the counsel for defendant
1552 should examine them and if they care to have additional passages offered in evidence, we will be glad to do so.

1553 (Objected to as incompetent, immaterial and irrelevant, and for the further reason that they are mere excerpts without showing the connection, extracts taken at random from the reports.)

The WITNESS. I prepared these excerpts from these various reports after carefully reading the reports, and my opinion upon the navigability of the Desplaines River was founded upon these passages which I have read in evidence.

1554 *Cross-Examination by Mr. Scott.*

I don't remember the date when I was first spoken to about this case by Mr. Cressy but I think it was somewhere in April

or May, 1910. I might have spoken to Lyman E. Cooley later on about the subject, but Mr. Cressy is the one that told me what was wanted. I can't remember having spoken to Mr. Cooley about it before that. I have no interviews with Mr. Cooley in regard to it. No arguments about it, except speaking to him about it, telling him I had gone over the mat-
1555 ter. I have had no interviews with him in regard to my testimony in this case except possible incidental mention of it as we met. I don't remember when I first spoke with Mr. Cooley about it because I have never made a special point of speaking to him about it. I don't remember anything that I talked with him about it except this, that he told me that he had told Mr. Cressy that I was familiar with this subject and possibly could go through those reports and make the extracts. I made the pencil marks where the excerpts are; that is what I wanted to take up. Wherever I saw any that I thought would have any bearing on the subject I read it through carefully. I am assistant engineer in the department; it includes the improvement of the Chicago river, Chicago harbor, Calumet harbor and Calumet river, Michi-
1556 igan City harbor and Indiana harbor.

I have been connected with this department in the capacity of assistant engineer since 1872; I was draftsman from 1871 to 1872.

I did not find mentioned anywhere in the reports anything about the water power, that I can remember; as for the use of the bed of the river, if that had been contemplated and not considered that the government had a right to use it there would have been estimates made for the cost; as all items affecting the cost are considered in making the estimates.

Move to strike out the last portion of the witness' tes-
1557 timony as not responsive to the question, beginning "As for the use," etc.

I have carefully examined Document Number 263 of the House of Representatives, "Report upon the survey with plans and estimates of cost for the navigable waterway fourteen feet deep, from Lockport by way of the Desplaines and Illinois rivers to the mouth of said Illinois river," and thence by way of the Mississippi river to St. Louis, Missouri,—the the one of 1905. I do not remember any expression to the effect that it was contemplated that there would not be any interference with the riparian rights of owners and with their water power. The marked passages on page 12, beginning as

follows: "The steep slope of the Desplaines River and
1558 of the Illinois River," is not in the book I used. I have a copy down there of my own and I used that. What I hold in my hand is a copy of the report in question. On page 11 there appears a heading "Vested rights."

Q. The following appears, does it not, on page 12?

Whereupon counsel for defendant read the following extract from page 12 of said article:

"The steep slope of the Des Plaines River and of the Illinois River above Utica is favorable to the development of water power. Rights of this nature have acquired additional importance with the recent increase in the discharge of the drainage canal, and will acquire still further importance with the further increase contemplated. An important water power has been developed by the State of Illinois at Joliet and is now in use under lease by a private corporation. The Sanitary District of Chicago is engaged in the construction of works for the development of water power just above Joliet. An important water power is in use at Marseilles. Various other
1559 schemes for the development of water power have been projected. In all such cases fixed dams, with their resultant back flowage, are a necessity. In fixing the location and height of its dams the Board has endeavored to avoid the injury of any of these schemes. It has succeeded in doing this for all that are developed and probably also for those that are undeveloped. It has accepted the levels of the pools at and above Joliet as fixed by the dam now in existence at the former and that under construction at the latter; and at Marseilles the canal around the rapids has enabled it to avoid the power dam at that place entirely. At other places economy in excavation and avoidance of overflow have been the guiding considerations. The best development of water power would no doubt in some cases call for a different arrangement. Fewer dams and those of a greater height and of the fixed type might, from that point of view, be desirable. The plan submitted is not designed to develop water power; but there will probably be no difficulty in modifying it so as to conform to such development if those who are to benefit thereby will co-operate with the government. They should pay the cost of the dams and the damages from flowage, which is no more than they would be compelled to do if the Government made no improvement."

The WITNESS. That appears upon that page.

1560 (Continuing): It certainly was considered that the power rights of riparian owners should not be affected or interfered with by the proposed improvement, but it does not prove that as I keep it in mind that the government would not have a right to improve the river. They may improve it in such a way as not to interfere with the water power. Aside from that reference I do not recall anything in any of the reports which indicate that the government intended that any of its projected improvements should interfere with the rights of riparian owners to avail themselves of their water power. I don't remember that the question of water power was ever considered. I am astonished to see this, but I don't remmber in any other report that the question of water power was considered at all.

1561 If the government had expected to damage the riparian owners there would have been estimates made to make good such damages, but if the government did not expect to injure such owners there would have been no occasion for such estimates. In these extracts that I have given I have generally referred to it as being either navigable or capable of being made navigable by ordinary river improvement. I have not distinguished between the two classes of references because I consider either case would make it a navigable stream. Either if it is presently navigable or

1562 can be made so, having the elements necessary for a navigable stream. I think there were several extracts speaking of it as being navigable in a state of nature without improvements. I would not say that positively because I did not consider that to be material. On being asked to refer to one extract that is in a state of nature without improvement, I do not remember any distinct passage, but in every instance in the report it speaks of improving the river, which of course would be always necessary in any river. I don't remember any passage of that kind indicating that it was navigable without improvement. As to whether the Willard and Barlow report to General Wilson, dated April 19, 1900, expressly state that the upper Illinois river and the Desplaines river are at present non-navigable, page 3061, I don't remember that. It is possible that it did, but that don't make any difference.

(Counsel for defendant handing document to witness.)

1563 The WITNESS. It does so state.

Whereupon counsel for government asked that the whole of the sentence be read.

Counsel for defendant then read as follows: "While the upper Illinois and Desplaines rivers are at present non-navigable, the commerce of the Illinois and Michigan Canal, which has been constructed in the valleys of these rivers may be taken to represent the present commerce of such a route."

The WITNESS. I did not think that that had any significance upon the question concerning which I was making extracts from these reports. The statement of the engineers that it was non-navigable would have no weight here, because it can be made navigable and that is all that is necessary to make it a navigable river of the United States according to the Supreme Court decision, as I read it.

1564 It would be easier to improve it if it was navigable before improvement. It would be easier to improve it if it was already navigable because there would be a less amount of dredging to be done. The fact that it is stated by the engineers to be non-navigable would have weight in deciding whether in a state of nature it was a navigable river.

I have said that all these reports except one advised the use of the river rather than of the canal. The next to the last one, I think, from Barlow's preferred the canal. Barlow's Report says: "The board appears to have come to the conclusion that owing to the change in the low water lines of the rivers, caused by the great increase in the flow of water through the Chicago Sanitary Drainage Canal, the Illinois and Michigan Canal should be enlarged and made use
1565 of rather than the beds of the Desplaines and Illinois rivers, between the mouth of the Kankakee river and Lake Joliet."

Counsel for defendant read the extract from page 3050, as follows: "The Board finds the most economic route for waterways of seven feet and eight feet depth to be from Utica to Marseilles in the bed of the river, 11.4 miles; then around the Marseilles Rapids by canal, 7.4 miles; thence in the bed of the river to near the mouth of Kankakee river, 21.2 miles; thence by enlarging the Illinois and Michigan Canal to the Joliet Basin, 16.3 miles; thence by canal through Joliet basin and along the east bank of the Desplaines river, 4½ miles, connected with the Sanitary Canal at Lockport, and thence through the Sanitary Canal and the Chicago river to Lake Michigan, thus complying with the terms of the Act of March 3, 1899."

The WITNESS. I did not read that passage on my direct, I did not think that that had any bearing to show the navi-

gability. I don't think that it was necessary when citing extracts rejecting the canal and adopting the river, in order to fully and fairly present what the reports show to
1566 read an extract rejecting the river. As a matter of fact if the waterway was constructed in accordance with the extract from that report which has been read, the entire river from the mouth of the Kankakee up to the basin at Joliet—which is at dam No. 1, would have been rejected if that report was adopted, but I felt that there were eight reports in favor of the river and one preferring the other, the canal. Therefore, I thought it was not of much importance. I do not remember that Captain Marshal's report was based upon a statute expressly providing that the Illinois river and the Desplaines river should be used. He certainly was to consider both routes. Page 2 of Executive Document No. 264 expressly provides that the improvement should be
1567 locks and dams in the beds of the Illinois and Desplaines rivers. In General Wilson's Report of 1867 he says, I believe, referring to the Desplaines: "The river itself except in floods is very shallow being often reduced in dry seasons to a mere brook, discharging less than one thousand cubic feet of water per minute." I don't remember now whether I have the extract of that or not. I don't believe I read that extract on my direct examination. A great deal I had to skip; I couldn't copy the whole thing. I made the most important extracts that I thought; I made a great deal of them too. The opinion of the engineers making that report, that the river was "a mere brook in dry seasons, discharging less than one thousand cubic feet of water per minute" and was very shallow except in time of floods has
1568 a bearing in determining whether the river in its natural condition was navigable; but as I understand it, that would not have a bearing on the final question as I understand it, whether that was navigable for making it navigable which I understand to be a navigable stream of the United States and I have been guided by one decision I have read by the Supreme Court, stating what constitutes a navigable river. I am not a lawyer but I think it was called 20 Wallace. My testimony is based upon my belief or understanding that the question of navigability is to be determined upon whether it is navigable in fact or whether it can be by ordinary improvements made navigable and has

the necessry element, the water to be let into it, and also in connection with other things.

Taking this necessary element of water to be let into it, in this same report the extract on page 440, the engineers reported as follows: "The Kankakee supplies water sufficient to make a good slack water navigation; the Desplaines of itself does not." I found that extract but that wouldn't make any difference because in the plans it is always estimated that the water should be taken from Lake Michigan for supplying that water. My opinion is that if the channel can be supplied with the necessary amount of water, no matter where you take it from, then it is a navigable stream of the United States, particularly if it connects with other navigable waterways.

Re-direct Examination by Mr. Cressy.

The government offered in evidence the paragraph which follows on page 442 of the Report of Major Wilson of 1858,

being the following passage: "But the valley (speak-
1570 ing of the Desplaines river) averages a mile wide and
is terminated on both sides by well marked terraces which become higher and higher as they approach the Illinois. Evidence at every step presents itself that the water when this was the great outlet of the lakes extended from bluff to bluff."

And also the rest of the paragraph from the report of Major Wilson of 1868, page 441, as follows: "And although the direction of the former was such that it was not probable that a favorable connection with Lake Michigan could be made through its channel, yet it was deemed advisable to determine that fact beyond cavil. We, therefore, caused a survey of the river to be made from its mouth to near the east line of the State of Illinois where it has but little current and drains by numerous crooked channels a large extent of country called the Kankakee marshes, but embracing much valuable land, portions of which are well timbered. (Refers to Kankakee and not the Desplaines.) The surveys and examination, as the accompayning report will show, have been highly satisfactory and furnish much useful information. The question of a connection through this channel with Lake Michigan for an improvement of large capacity has been

definitely settled:

1571 "1. There is too great an elevation (100 feet where the line was run) between the Kankakee and

the Calumet rivers, through which the connection could be most cheaply made, if made at all.

2. The Kankakee river which at the State line is 40 feet above Lake Michigan would not afford sufficient water to supply a canal and lockage, both ways, for a maximum business.

3. The distance would be 50 miles greater than by the Illinois and Michigan Canal. If the connection were made with the Lake at the mouth of the Calumet which is the best point south of Chicago.

4. It is believed to be impossible to construct a good and safe harbor at the mouth of the Calumet, available at all times, and no other should be adopted as the terminus of the proposed improvement.

Another route by way of Fox river, which forms a junction with the Illinois at Ottawa has been suggested, notwithstanding the former surveys of portions of the river and gauges showing the quantity of water at the lowest stages had rendered its feasibility improbable."

And also a paragraph from General Wilson's Report in 1900, found in appendix MM of the Annual Report of the Chief of Enginers for 1901 concerning the River and Harbor Act approved March 3, 1899, as follows:

1572 "The Secretary of War is directed to appoint a Board of three engineers, which board shall make a survey and estimates of costs for the improvement of the upper Illinois river and lower Desplaines river in Illinois, with a view to the extension of navigation from the Illinois river to Lake Michigan at or near Chicago; said board of engineers shall report the estimates of costs for a channel seven feet deep and also for a channel eight feet deep throughout said proposed route;" * * *

Also the paragraph on page 3050: "For the remaining canal divisions, the width will be not less than 130 feet at water surface and the depth ten feet, but the locks are reduced to 40 feet width by 260 feet between miter sills, with fixed bridges, giving 22 feet headroom, the Board is of the opinion that these dimensions should furnish ample navigation for the largest barges heretofore in use on the Mississippi river and that the combination will afford a waterway of ten feet depth at stages two feet above extreme low water in the Illinois river of sufficient capacity for any through barge traffic likely to seek it."

6671

The WITNESS. I should like to explain one thing in
1573 answer to the question of counsel for defendant. Counsel asked me if Major Marshall was not directed to make the survey along the Illinois and Desplaines rivers, which was shown in the heading. I wish to add, in my reply that I made then, that that probably was done by the Secretary of War because all previous surveys had favored that route and therefore it would be unnecessary to make any examination of any other one. That is my opinion.

Move to strike out the statement of the witness, as simply his opinion and conclusion as to a matter of which he professes and has no personal knowledge.

I heard you referred to as Major while on the stand?

The WITNESS. I am not in the engineering depart-
1574 ment of the Army and have no title of "Major." I am a Civil Assistant Engineer. The Chicago District Engineer's Office with which I am connected at some time had control over the Illinois and Mississippi Canal and the Illinois river. I do not remember those years when it had control over the Illinois river. It has been changed so many times that I do not know that I can remember exactly the years. There is a change going to take place this Spring I understand and we get back to the Illinois river again. I can easily find out, of course, if it is important.

1575 COUNSEL FOR THE GOVERNMENT. I will ask you if you were furnished by the District Attorney a copy of a portion of the decision in the Montello case which reads as follows: "This court held in the case of The Daniel Ball, 10 Wall., 557, 19 L. ed. 999, that those rivers, must be regarded as public navigable rivers in law which are navigable in fact. And they are navigable in fact when they are used or are susceptible of being used in their ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water. And a river is a navigable water of the United States, when it forms by itself, or by its connection with other waters, a continued highway over which commerce is, or may be, carried on with other States or foreign countries in the customary modes in which such commerce is conducted by water," and if you used that opinion in examining the various nine reports?

Objected to as incompetent, immaterial and irrelevant.

1576 The WITNESS. Well, we got a copy sent forward to our office from the Chief of Engineers, of the same decision, on account of the question of the navigability of Lake Calumet, so I saw it there again, that one and one more, and of course that confirmed the impression that I previously had as to what constitutes a navigable stream of the United States. I used that in forming my opinion.

COUNSEL FOR GOVERNMENT. Let it be shown that this extract is taken from the United States vs. Steamer Montello, 20 Wallace, 430.

Re-cross Examination by Mr. Scott.

I have seen on the map Hickory Creek that enters into the Desplaines river down about Joliet or connects with it. I know too little about it to express my opinion whether Hickory Creek is a navigable water of the United States.

1577 I know Stony Creek out at the Calumet river. That does not make any connection with any other waterway, and, therefore, I should not consider that was a navigable stream. It runs into the Calumet river. The Calumet river is a navigable stream. That is a tributary, I don't consider it to be navigable. If it is a little rivulet that runs into a river somewhere, I don't consider it navigable; but if it had a connection at the other end with another navigable river, then I should consider it, because that is the way you can connect the water and you can get the water in and you can make it navigable.

(Witness excused.)

LYMAN E. COOLEY, witness for the Government:

Cross-Examination Continued.

1578 I feel a deep personal interest in the result of this suit. As to whether my interest in this case is not solely that of a witness called to testify as to matters within my knowledge, I will say it is. It would not be true that if I were not a witness in this case I would have no interest in how it resulted.

Q. Is it not then true that you have an interest aside from your relation as a witness in this case?

Objected to as not proper cross-examination.

1579 A. Not as a witness.

Q. You will notice the question excluded the relation of witness, and asked whether you have an interest aside from that.

Objected to as not proper cross-examination.

A. Independent of my relation as a witness I have an interest in the case as a citizen, but that has no effect upon my duties as a witness.

Whereupon counsel for defendant moved to strike out "but that has no effect," and on the end of the answer, as not responsive to the question, and stated that no question had been asked the witness as to whether or not his interest has effected his testimony in this case, nor would any such question be asked him.

Whereupon counsel for government stated that in order that there may be no question about it, the question and answer might stand as direct examination, and counsel for defendant might cross-examine him as to whether or not his personal feelings would have any effect upon his testimony.

Whereupon counsel for defendant objected to such question, on the ground that it is incompetent, imma-
1580 terial and irrelevant.

Mr. COOLEY (continuing): I have an interest as a citizen; my interest as a citizen has been peculiar and extraordinary as compared with the interest of most citizens in this litigation in this way: I am professionally identified with the proposition of a waterway and have been from the beginning, which was as early as 1875; and the purpose of that was the possible development of a deep waterway down this river. A very considerable portion of my time in the last quarter of a century has been occupied in the direction of making that plan a reality. I deemed the erection of this dam by the defendant an obstacle in the way of carrying out that purpose. As to whether I deemed it essential that the river bed and the flow of the water should be controlled by whatever government, whether state or whether United States, carried out that improvement, I would say "Es-
1581 sential" is a little too strong a word. I deemed it to be important to sound public policy for the State or the United States, or whoever constructed the waterway, to control all the structures in the waterway.

Q. Have you taken any part in securing legislation in the

State of Illinois with a view of realizing this project of the development of the river?

Objected to as not proper cross-examination and as incompetent, immaterial and irrelevant.

A. I have.

As to when my activities of that nature began, I would say I have always entertained the same idea in regard to this; it is a little difficult for me to state when my activities began. As to whether I can recall when I first took any part in the effort to procure legislation to this end, I would say it was either 1905 or 1907. As to whether I had anything to do with any legislative procedure about 1893 or 1894 with reference to this contemplated improvement, I would say I had a bill in the Illinois legislature in 1895. That 1582 bill was for the appointment of a Waterways Commission by the State of Illinois. At the time the function of that commission was similar to that of the Internal Improvement Commission created ten years later; that is to make an investigation and determine officially upon plans for the improvement of the Illinois river and the Desplaines river, and enlist the co-operation of the United States. I prepared exhibits in connection with that proceeding and exhibited them before the legislature. The Commission bill was vetoed by Governor Altgeld. As to whether I took an active part in an effort to procure legislation on this subject, I would say I prepared a bill in 1895 for the proposed Commission and submitted the bill to the legislature but it was vetoed by Governor Altgeld.

Whereupon counsel for the government stated a desire to object to all this cross-examination, as not being competent cross-examination, and further on the ground of its being incompetent, irrelevant and immaterial, and asked to have the objection stand without repeating it to all the questions concerning this matter, which objection was consented to by counsel for defendant.

A. Why, the same bill was reintroduced in the legislature of 1907, but it was not pressed to a vote. I was at Springfield in connection with that bill when it was introduced, in 1897, for the Sanitary District. I made some effort to procure the adoption of the Commission bill but at that time the matter was not pushed. The next I did in procuring legislation to carry out this object was in 1899 or 1900. I went to Washington and procured the insertion in the River

and Harbor Bill, of an item requiring the Board of Engineers then sitting, known as the Barlow Board, to report upon the feasibility of a deep waterway from the Chicago
Drainage Canal to the Mississippi river. I devoted
1584 about a week to the effort to procure that legislation.

My next action was in 1901. I took part in committee appointed by the Peoria convention to secure legislation at Washington, and the result of our efforts was to procure the insertion of an item that was carried out by the Ernst Board. That committee was really appointed in 1899, I believe that was the date of the Peoria convention. Both of my visits to Washington were in connection with that matter, although in 1900 and 1901. Subsequent to 1901, I took an interest, in 1905, in the passage of the Internal Improvement Commission bill at Springfield. That bill provided for the appointment of three commissioners to study the general subject of the overflowed lands, particularly, and of a water-
way through the Illinois Valley and appropriated seven
1585 thousand dollars for that purpose. I spoke of the Illi-
nois Valley; I include in that the Desplaines River Valley. I was secretary of that commission. I continued to occupy that position for about two years, ending March, 1908, and I was consulting engineer for the following year. The position of secretary was a salaried position. The position of consulting engineer was a salaried office also. As to whether there was any legislation that I interested myself in or took part in procuring, in connection with this project, I would say I was interested in the consideration of the matter before the legislature following the report of the Internal Improvement Commission, the passage of the constitutional amendment, and promoted the constitutional amendment as
part of my official duties. The constitutional amend-
1586 ment referred to authorized the legislature to appro-
priate twenty million dollars for the improvement of the Illinois and Desplaines river from the end of the Sanitary Canal at Lockport to Utica. I was advocating the passing of that amendment from sometime in July, 1907, until its passage in October or November, 1908. I would say I prepared a brief statement which was circulated among the voters of Illinois, and made a few speeches. I went out in the state among the voters upon a few occasions and made a few speeches, down into Kendall County, and in different Chicago districts. I did not make any other speeches outside of Chicago except the one I refer to in Kendall County.

At the time I was actively engaged in bringing about or seeking to aid in bringing about this amendment, I was secretary and consulting engineer. As to whether I was at
1587 any time under salary or in the employ of other associations or body in connection with this general project of a deep waterway down the Desplaines river, prior to that time, I would say I was not except as a member of the Board of Trustees of the Sanitary District and in my employment by the City of Chicago. I refer to the time when I was employed by the City of Chicago in the formulation and passage of the original Sanitary District Act. As to whether subsequent to the time when I was active in seeking to secure the passage of the amendment I was in the employ of or paid by any other body or association for work in aid of this projected improvement, I would say since October, 1909, I have been the consulting engineer of the Lakes-to-the-Gulf Deep Waterway Association, the purpose of which was to pass a deep waterway from the Great Lakes to the Gulf of Mexico.

My employment with the state continued up to the first
1588 of April, 1909, as consulting engineer of the Internal Improvement Commission.

As to whether I have mentioned all the legislation that I was active in promoting in connection with this project, I would say there were other bills which I introduced in the legislature other than those mentioned, or been concerned in but none of them were passed and some of them were not pressed for passage, all relating, however, to the same general subject. As to how many of these bills were not included in my former testimony, I would say I had a bill in the legislature of 1905, quite an elaborate bill for the consolidation of the Sanitary District and the state agencies which had to do with waterways but the matter was not pressed to passage. There were two or three other times where bills were drawn and where legislation did not seem to be due. That is all the general bills that I now think of on the subject. I think there were one or two efforts at Washington where we did not get legislation. As to whether we went to Washington for the purpose of getting legislation at other times than those I have specifically mentioned, I would say not specifically. I was in Washington on other occasions when the matter was discussed.

Q. Did you have any idea or did you busy yourself
1589 concerning the passage of the bill of the 6th of December, 1907, in the legislature of the State of Illinois en-

titled "A bill for an Act recognizing the Desplaines and Illinois rivers as navigable streams, and to prevent obstructions being placed therein, and to remove obstructions therein now existing"?

Objected to as not proper cross-examination.

A. I did.

Q. What did you do in that connection?

Same objection.

A. That was part of the constitutional amendment legislation; I had included that as incidental to the constitutional amendment and was active in securing the passage of that bill as I was in the constitutional amendment.

Q. That bill was specifically directed against the project of this defendant, was it not, which is also attacked in the bill in the suit in which you are now testifying?

Objected to on the ground that the bill speaks for itself, and not being proper cross-examination.

Q. I will alter the question.

Q. You say you were active in procuring the passage of it in substance. Your understanding at the time that you were so active, was that it was directed against the proposed dam of the Economy Light & Power Company in the
1590 Desplaines river at Dresden Heights, being the same project which is attacked in the bill in the suit in which you are now testifying; is that not so?

Same objection.

A. The bill was not specifically drawn in that respect, and applied to any obstruction in the river as well as that mentioned.

My understanding for the purpose was that it applied to anything that might interfere with the construction of the waterway as proposed by the constitutional amendment, and that it applied at that time to the things in sight which were the Economy Light & Power Company's dam at Dres-
1591 den, and the Marseilles dam. The Marseilles dam was in the Illinois river. As to whether the only thing in the Desplaines river it applied to was the Economy Light and Power Company dam, I would say not necessarily. There was the State dam at Joliet, and properties in dispute below the State dam between the Sanitary District and the Economy Light & Power Company.

Q. Was there any other company or interest that you understood the bill was aimed at excepting the Economy Light

& Power Company so far as the Desplaines river was concerned?

Objected to on the ground that the bill itself states what its purpose and object is, and further, that the testimony is incompetent.

A. I cannot see that the words "aimed at" quite express my idea in the matter. The Economy Light & Power Company was probably one of the exciting causes which led to the bill. At the same time the bill was equally important for other purposes, as a collateral matter; as a constitutional amendment or as collateral to the constitutional amendment.

Whereupon counsel for the government moved to strike out all questions and answers referred to the purpose or aim or object of the bill before the legislature in 1907 in reference to the navigability of the Desplaines
1592 river, referred to by counsel on cross-examination, as not proper cross-examination and having no bearing whatever upon the issues in this case.

Q. Mr. Cooley, did you at about the same time seek to have passed in the legislature a joint resolution in substance cancelling contracts made by the Canal Commissioners with certain persons whose rights were afterwards acquired by the defendant in this case in connection with the premises at Dresden Heights?

Objected to as not proper cross-examination, and as incompetent, irrelevant and immaterial, the question of the validity of those contracts not being in issue in this case.

A I had nothing to do with that resolution. That was incubated by the representative from Peoria.

At the time this bill on the 6th of December, 1907 was before the legislature, I do not remember that I publicly stated that the Economy Light & Power Company was working with feverish haste to complete its dam before the bill could become a law. I did not visit the dam personally at that time.

I did investigate the dam prior to the passage of this bill.
1593 There is no regular salary attached to the position which I held in the Lakes-to-the-Gulf Deep Waterways Association. I was compensated for services rendered from time to time. The last service I rendered in that connection was yesterday or the day before. The specific work I was then doing was giving some advice to the secretary, Thomas H. Lovelace. After the passage of the Act of the 6th of December, 1907, a bill was filed in the Circuit Court of Grundy

County, Illinois, on the 30th day of December, 1907, by the Attorney General for the *People* v. *The Economy Light & Power Company*, connected with this dam. I am the same
Lyman E. Cooley who swore to that bill. I recall sign-
1594 ing the bill of complaint. As to whether I was active in
bringing about the instituting of that litigation, I would say I was employed by the State at the time and assigned to the duty of assisting the attorneys of the State. I was then secretary of the Internal Improvement Commission. I did receive compensation for my employment in being assigned to aid the attorneys other than my salary as secretary, from the State of Illinois.

Q. Professor Cooley, how much of your time, from the beginning of that suit until the end of the trial in the Circuit Court, did you give to that case?

Objected to as incompetent, irrelevant and immaterial.

A. I gave a large portion of my time; nearly all of it.

I assisted the attorney for the state in preparing for
1595 the trial. As to whether I recall that the trial began
about the 20th of April, 1908, I would say I don't remember the date; it was about that time. I recall that it continued until the last week in June of that year. As to how much of the time that that case was on trial I was present in court, I would say a considerable proportion of the time. As to whether substantially all of my time was devoted to the case during that period and I was substantially in court during all of that time, I won't say about being in court; I was either in court or engaged in the compilation of matters requested by the attorneys.

Q. What compensation did you receive for your services from the state in that case?

Objected to as incompetent, irrelevant and immaterial.

A. I do not recall.

Q. Would you state as nearly as you can recall?

Same objection.

A. Independent of the Internal Improvement Com-
1596 mission I think it was about $2,000; but I would not be
specific about that. I have not the figures in mind. I was paid by the attorney general. My salary with the Internal Improvement Commission for that period was $300 per month.

Q. After the decision was rendered by Judge Mack, what

if any part did you take in assisting the attorneys for the state in the matter of the appeal?

Objected to as incompetent, irrelevant and immaterial, and as not being proper cross-examination; and having nothing whatever to do with the issues in this case.

A. Why, I called upon the attorneys whenever I was sent for to furnish any matter or information that they needed from me.

I did not receive any compensation after the decision by Judge Mack for my services in the preparation of the appeal, otherwise than my salary as consulting engineer of the Internal Improvement Commission. I do not recall when the Supreme Court of the State of Illinois sustained the decision of Judge Mack in that case; I think it was in October,
1597 1909, at a time when I was in Europe. I was absent from the country about a couple of months.

Q. What was the purpose of your visit to Europe at that time?

Objected to as incompetent, irrelevant and immaterial.

A. To examine several of the rivers and waterways and harbors of Europe, with special reference to a National Waterways Commission.

The National Waterways Commission was a joint committee of the House and Senate that was appointed to go to Europe to make a study of waterways and recommend a policy for the United States, and in pursuit of their duties they made an extended tour of the rivers and harbors of Europe. I went there to assist Senator Lorimer, who was a member of that committee. I was employed by Senator Lorimer and my expenses were paid by him. I received no compensation for my time.

Q. Senator Lorimer has been actively engaged, has he not, in endeavoring to procure the construction of a deep waterway down the Desplaines river?

1598 Objected to as incompetent irrelevant and immaterial.

A. He has. The project which he has proposed and supported has also been supported by me. I returned to this country from that trip the last of October, 1909. The next step I took with reference to the project of a deep waterway down the Desplaines river was about the 1st of December, 1909, preparing a number of exhibits for the Lakes-to-the-

Gulf Deep Waterway Association, for use in presenting the cause of the Lakes-to-the-Gulf waterway before the Committees in Congress at Washington. Among other
1599 things the exhibits involved the improvements of the Desplaines river. As to when, if at all, I busied myself next with reference to the Economy Light & Power Company's proposed dam in the Desplaines river, I would say in April or May, 1910, when I was sent for by the United States District Attorney, Mr. Sims, I think.

Q. Had you prior to that made any suggestions to any persons representing the United States as to the desirability of bringing an action in the name of the United States against the Economy Light & Power Company?

Objected to as incompetent, immaterial and irrelevant and not proper cross-examination.

A. Not for a year or two prior. After the decision in the Supreme Court and before I was sent for by the United States Attorney, I do not recall that I took any steps or made any suggestions with reference to the bringing of such litigation I have not had any conference with Mr. Wickersham with reference to this litigation. At the time I was sent for
1600 by the District Attorney in April or May, 1910, we went over the exhibits in the state case, for which he had sent for me. I do not remember the details of the conversation. I think it was turned over to Mr. Wilkerson or Mr. Cressy. I do not think anything further was said so far as Mr. Sims was concerned, except to speak of this case and turn me over to Mr. Wilkerson. The substance of my conversation with Mr. Wilkerson was with regard to procuring my services in connection with the case, as to whether I would be available or not, or could be available. The matter at that time depended on how soon I would complete my work that I had in hand for the Lakes-to-the-Gulf Waterway Association. Subject to that I was available. As to what relations were established between me and the United States with refer-
1601 ence to this litigation, I would say I was engaged for services rendered, to be paid according to the services rendered. I was engaged at that time subject to the limitations that I have spoken of. I began actively the performance of duties for the United States in connection with this litigation in May, 1910. I do not know what time in May. I remember putting in two or three weeks in May and June on the subject. As to how much of my time since I was engaged has been given to this

litigation, I would say about 18 days in May and June, and then the matter was not resumed again until some time in November; I couldn't state specifically. It was about the time Mr. Alvord was put on the stand. As to how much of my time since that has been devoted to this litigation, I would say part of my time from that up to the 1st of January and since the 1st of January practically all of it. During the taking of testimony prior to the 1st of January I was present substantially all of the time when the witnesses for the United States were being examined.

1602 Q. You were engaged in assisting the attorney for the State outside of the hearings during that period, were you not?

Objection to the form of the question, on the ground that the attorneys for the State had nothing whatever to do with it.

A. I was requested to be present at the hearings by the attorneys for the United States for the purpose of listening to the historical evidence.

Whereupon counsel for the defendant moved to strike out the answer as not responsive to the question.

(Question re-read.)

A. The word "assisting" does not convey the proper meaning to my mind. I was assisting in the sense of an employe carrying out their instructions.

Q. What basis of compensation exists between you and the United States for the time given by you to this litigation?

Whereupon counsel for the government objected to said question as not proper cross-examination, and requested the witness not to answer.

After some colloquy it was agreed that the questions relating to this subject might be deferred until a later time, when the objection on the part of the government might be withdrawn; with that understanding the two following questions were also asked:

1603 Q. How much money have you already received from the United States for your services in connection with this litigation.

Witness directed not an answer.

Q. In addition to the moneys already received by you for your services in connection with this litigation, how much money is now due you for those services?

Witness directed not to answer.

As to what capacity I was engaged in by the United States

in connection with this litigation, I would say I was employed to study up the physical matters in connection with the case, and see what the evidence in that respect would show, the facts representing the conditions of navigability on the Chicago Divide and in the Desplaines river. As to whether
1604 I was also employed to act as technical adviser in the matters that had to do with my profession as engineer, to the attorneys for the United States in this litigation, I would say it had not occurred to me in that way. I have given advice whenever called upon. I have not at any time gone on any missions away from Chicago for the United States in connection with this litigation. I have not conferred with engineers at other places concerning this litigation, other than instructing draughtsmen in the preparation of exhibits. Since I was employed in this litigation I have been to the site of the proposed dam of the defendant on the Desplaines river. I was there in July and again in December. In July Professor Alvord and Mr. Cressy accompanied me; in December Mr. Cressy, with three engineers; Mr.
1605 Meigs was one of them. He is an engineer connected with the United States, in charge of the canal at Keokuk. I do not remember his initials.

Whereupon counsel for the government stated that his name is Montgomery Meigs.

Mr. B. F. Thomas also was with us. Mr. Thomas is an assistant engineer of the Ohio river and tributaries, working for the United States. There were two pilots also on that trip. I do not remember the names. One of them was from the Mississippi river at Rock Island. The other, I don't know where he lives. The purpose of that visit to the dam was to look over the Desplaines river from Dam No. 1
1606 to the mouth, with a view to the United States' case in this pending litigation, with a view to the giving of testimony of those gentlemen I have named. As to whether I have at any time or place conferred with any witnesses or prospective witnesses for the government in this litigation, I would say the word "conferred" does not belong there because there was no conference. I went along to accompany the party and give them such information as I possessed or they might wish. As to whether I met or talked with any other witnesses or prospective witnesses for the United States in this proceeding, I would say none except the men who were engaged in the preparation of exhibits,

Mr. Parry and Mr. Kramer. Mr. Parry is in my employ. I have an office on Quincy street in this city. No one besides myself occupies that office. Besides Mr. Parry, part of the time Mr. Edgar Williams is employed by me. Mr.
1607 Williams has been employed since late in December. Mr. Williams was working on the Lakes-to-the-Gulf Waterway matter; he put in about a week on this matter I believe, under my direction. Mr. Parry's work was under my direction. Mr. Kramer's work was not especially under my direction. I mean by that that he was employed by the United State's Attorney's office, to prepare some exhibits, and he did that himself and not under my direction. Mr. Parry was employed by me and Mr. Kramer by the United States Attorney. Since 1907 I have been employed in and about the engineering work connected with the Minne-
1608 sota Canal & Power Company in 1907, engineering work at Grand Rapids, Michigan, in 1908, I think July and August, 1908. I was employed by the city of Grand Rapids for the purpose of studying flood problems there. As to how long that employment continued, I should say it has been going on at various times since 1904; I put in a month on it or six weeks this year on the subject, and two or three intervals since, or between that and 1908. I am not in administrative charge of that work. The city engineer was in charge of it. My connection with it is consulting engineer. As to how much time I have given it within the last three years, I would say four or five months probably. I am
1609 not paid a salary. As to what compensation I have received for that work in the last three years, I would not know without looking it up. As to whether I can approximate it, I would say somewhere between $3,000 and $4,000,maybe $5,000, probably between $3,000 and $4,000. My recollection is that I was paid by the city of Grand Rapids. I would not like to state positively without refreshing my mind on it. As to the other work that I have done since 1907 in my profession, I would say I was employed by the city of South Bend last year in connection with the water litigation between that city and Mishawaka, being em-
1610 ployed in the capacity of engineering expert; first to make an examination to see whether a trial was warranted or not, and later in giving testimony in the case. In the matter of executing engineering work I have not done any for ten years. Outside of court proceedings, as to what

other work I have done since 1907, I would say I have made a trip to Yorktown, Virginia, last year, to examine a proposition in Portland cement. I was engaged in that a month or two. As to whether I did any official work in that connection I would say that was official work. I did do engineering work in connection with it. I examined the proposition and passed upon the merits of it. I did not run any in-
1611 strument nor make any plans. There were no hydraulic properties connected with it. I was away from Chicago on that proposition a month or six weeks. As to what other work since 1907 I have done in the nature inquired of, I would have to go over that in my mind before I could answer further.

1612 Q. What compensation do you receive in your official position connected with the Lakes to the Gulf Deep Waterway Association?

Objected to as incompetent, immaterial and irrelevant, and not proper cross-examination.

A. There was no definite sum agreed to. I cannot say that there was any basis of compensation agreed upon.

Mr. Parry is employed by me by the day. Not continuous, but whenever I happen to need his services. That is also true with Mr. Williams. I have not any other office employes.

As to during what years I was in general charge of physical research upon the streams of the Mississippi valley, I would say that work was going on from 1879 to the time I left the service of the government in 1884, and I had particular
1613 oversight over the matter in the office of Major Suter during the last two years of that employment. As to whether the position had any particular title, I would say it was not a position. I simply worked under the direction of Major Suter. Put in a good deal of time upon it and supervised in a general way the work of other assistants in the office. I was then Major Suter's chief assistant. I think there are not any reports of that period published of the work done by me on the subject of physical research. It was all done for Major Suter in his investigation and for the Mississippi River Commission and they made use of it for their own purposes. The work was done under the direction of Major Suter. As to whether it is necessary that a man should have any particular standing as an engineer or a scientist to be a member of the American Geographical So-

ciety, I would say nothing more than that he is a reputable man himself and gets three reputable men to certify to
1614 him; a lawyer who could get that sort of backing and pay two dollars a year can become a member.

I have testified that below Romeo there is a declivity at the rate of seven feet per mile from the Romeo highway down to the head of Lake Joliet, a distance of 11 miles, pretty uniformly distributed. As to whether I mean by that that at the rate of seven feet per mile is pretty uniformly distributed between those two points, I would say fairly well, unusually well for a slope of that character. To give in detail concerning the slopes after leaving Romeo, there is a sharp pitch at Romeo for about a mile where the slope is higher than that. I would not state offhand how high. The slope gets flatter down for about a mile and a half and it pitches off eight or ten feet to the mile for a mile towards Lockport. Then there is a pitch at the wire mill dam. How much that pitch was before the dam was built is not quite clear. The slope flattens a little from there down to the E. J. & E. road, a little less than seven feet to the mile, and then it holds to seven feet to the mile from there down to Lake Joliet for the next five miles in the absence of the dam; as far as we can judge the original profile opposite the
1615 dam. The distance from Lockport to Joliet is about four miles. The fall from Lockport to Joliet is about 30 feet. I am taking my point at about the rear of Norton's mill; it is about 20 feet below Chicago datum down to the foot of dam number 1, which is about 50 feet. From Norton's mill above for about a mile there is a fall there of 10 to 11 feet. Then added to my 30 feet, there would be a fall of 40 or 50 feet in about five miles. There is a fall at the
1616 rapids of Treat's Island of 9½ feet in about a mile and a quarter, as I remember it. There is a fall in the rapids at the mouth of about 3½ feet in .6 of a mile. As to what stage of the water as shown by the Riverside gauge the discharge would cease, I would say 11 feet. That is the way the gauge now reads. I do not know how long it has read that way. As to whether the point of no discharge is 11.4, I would say it used to be. I do not know when it ceased to be that. I know that because that was the record when I was familiar with the gauge. I was personally familiar with it in 1886 and 1887; since then what I know is from the records. I do not recall how long the records says 11.4 con-

tinued to be the point of no discharge. As to whether it is not the point of no discharge up to 1905, I do not recall.
1617 I know that I used the figure 11.4 in the state case. I do not recall whether I did or did not indicate that that point no longer indicated the point of no discharge in the state case. I think that was my impression at that time, or my information. As to whether I have any knowledge of any change in the gauge since 1905, I would say I have knowledge that the gauge has not been changed as to location since it was established. I have not any knowledge of the change of the point of no discharge in the gauge. As to whether anything has come to my knowledge since that time that I did not then know as to any change in the gauge that I did not know then, at the time of the state case,
1618 I would say I am not absolutely positive as to my statement in the state case; it has come to my knowledge since, when I cannot say, that the point is lower, the point of no discharge is lower than 11.4. The reason for that is the fact that when the gauge was established there was a species of weir dam made by rock and sod on the ripples down below or some point between there and the township line by which the water was held up in order to furnish boating for the town of Riverside, and that probably at some time washed out by floods and was not renewed.

I learned this first by comparing the records of flow at Riverside, those low stages, with the gauge records, and that led to my making some inquiry in the matter and the explanation is as I have stated; but I have not learned when that change did occur. As to whether as a matter of fact wherever and whenever it occurred the fact is indicated at the top of the tables of the Riverside gauge as published in the report of 1905, I would say that I do not know; they were not reported for 1905 as far as I know. As to whether it is a fact that that was a condition which changed from time to time, a portion of the time being 4/10 of a foot lower as shown by the elevations at the top of the table, I would say I don't know; I have not examined that. I have noticed that at the foot of the tables when the water gets below 11.4 on the gauge there is a printed footnote or memorandum of "No discharge."

At this point followed a colloquy between counsel in reference to the production of certified copies of the Riverside gauge records from the Sanitary District from 1904 down to 1910.

1622 Referring to the summaries of the number of days in the year in which the water stood at certain elevations or above certain elevations on the Riverside gauge, I attach to averages of this nature a very important value in determining the navigability of a stream. It is the method which we use in doing so. As to whether there are other elements which must be considered in order to draw any just or valuable deductions from the average number of days at which the water stood at a certain reading, I think that is clearly implied, that there are other elements in the matter. The question of ice is one; the question of continuity of stages is another. But those things pertain to all records of that kind so that the average is a relative measure. It would be important to know what portion of those days representing a certain elevation occurred during the period or the season of the year when navigation is conducted in such a stream.

Q. What is the period of navigation during which the Illinois and Michigan canal is open for navigation?

Objected to as incompetent, immaterial and irrelevant and as not proper cross-examination.

1623 A. I don't know what the period is.

As to whether it is not April 1st to December 1st, I would say that is probably correct; that is the official period of navigation. I refer to another element, namely, whether these days appeared consecutively; that is important because a continuous navigation is more valuable than one that is broken up into periods, although stages of water at any period of the year would be valuable but not so valuable or material. As to whether it is not also an element in determining the navigability of a stream for use for purposes of trade and commerce that certain stages or conditions in the river recur approximately with regularity at certain seasons of the year, I would say that is a betterment, perhaps, but all stages would be useful and are used in navigation of rivers.

1624 Counsel for the government stated that he would secure from the Sanitary District gauge readings for the years 1904 to 1910 duly certified to and on the same basis as those given in document No. 263.

Whereupon counsel for defendant stated that that would be satisfactory as far as form goes.

1625 Mr. Cooley (continuing): In regard to the question of other employment, I have since recalled a number of

engagements since 1907; one was at Beardstown, Illinois, in connection with the drainage district on the Illinois river bottoms. Another was the adjustment of a contract in dispute on one of the lines of the McKinley system, a contract for work. Another was the consultation and examination for the Corn Products Company, their works at Waukegan, Illinois. Another was consultations in regard to some phosphate beds in Florida. Also a water power in Cuba; also the appraisement of the water works at Racine, Wisconsin, and also the adjustment of a contract for the American Surety & Bonding Company. The adjustment of a contract with the American Surety Company could not have been done except by an engineer. It was one of the collateral matters. As to what time was involved in it on my part, I would say the matter is still open. I have spent I presume ten days on it. I think the amount involved is about $30,000. The

adjustment of the other contract was a contract for the
1626 grading of one of the lines of the McKinley system in this state. I was one of the arbitrators to dispose of that and settle the matter between the McKinley company and the contractor. As to whether the matter that I referred to as to a water power in Cuba went any further than a consultation as far as my relation to it was concerned, I would say there were several consultations about the matter but not outside of my office. The same was true with respect to the Florida phosphate matter. I did not prepare any plans in either case. My work at Beardstown was the examination of the drainage district as to ditches and whether the works had been properly planned and whether the contracts had been properly carried out. That was done about two years ago. At that time there were about two or three weeks of my time involved, and some time since has been in-

volved in the matter within the last year. I did not
1627 make any drawings or plans with reference to that work. I made a report of the result of my observations. The nature of my employment with the Corn Products Company at Waukegan was to examine the question of lake pollution there and the methods employed by the Corn Products Company in disposing of their waste, and to give advice in regard to the pollution of the lake, and what further measures they should take to meet certain sanitary objections that had been raised. That was about two years ago. As to whether that was before they built or established their new

plan of settling tanks, I would say those experiments were going on at that time and their final development was the result of the conferences that I had with other experts in connection with the matter. As to whether that was before or after they had extended their discharge pipe a much greater distance into the lake than it had before been discharging, I would say they extended the discharge pipe at that time.
1628 My consultations were before they completed that work.

As to whether the consultations were to be determined upon that plan of trying to meet objections that had been made as to the pollution of the lake, I would say I am not sure of that. They made some extensions of the pipe at that time; when my consultations came in they were working on the sedimentation plan. I think that was since 1907. My consultations there were with Dr. Wagner. I made a visit to Waukegan, looked over the plant and met Dr. Wagner a number of times in his office there, not in my own office. I did not design any of that scheme of endeavoring to avoid the pollution of the lake by the Corn Products Company. I had nothing to do with the preparation of drawings or specifications. The extent of my participation in that was a few consultations with Dr. Wagner and one visit to Waukegan.

As to whether in order that there should be a profitable navigation for the purposes of commerce, it is essential that persons desiring to use the channel for a medium of transportation should be reasonably certain that at given times the channel or medium will be capable of such use, I will say that certainty is useful and important and leads to the
1629 improvement of rivers to make it continuous. Nevertheless, the Ohio river is used always whenever there is a boating stage, or what they call a coal boat rise, even if it lasts only a few days or weeks. In the case of the Ohio river it is usually true that for certain seasons of the year persons employing that river for purposes of commerce can be reasonably certain of stages of water that will permit its use, but not always. There have been omissions which have occasioned a very large accumulation of coal at Pittsburg for a long time.

Q. You have described a certain type of boat in your direct examination, and you have stated what the capacity of that boat would be at certain conditions of water. As, for instance, what it could carry in addition to its crew and their supplies, and belongings, upon a draft of 20 inches of

water, and what it could carry upon a draft of 15 inches of water, and what it could carry upon 12 inches of water. Now I would ask you to assume the following conditions: First, that the depth of the water in the river at Riverside as shown by the gauge is the depth from Riverside down to the mouth; second, that the river from Riverside to its mouth is improved by clearing out of it all boulders and other obstructions and straightening the crooked places; third, that the slopes, if any, which prevent navigation, are flattened
1630 out so that they are navigable; and taking the year 1886, which is the first year the record shows readings at the Riverside gauge, the record for that year beginning on the 15th of May and running through the remainder of the year, I will ask you if you have undertaken to determine from the gauge readings, as shown in House Document Number 263, at page 511, on how many days from May 15th to the end of the year a boat such as you have described could have passed down that river drawing 20 inches of water?

Objected to on the ground that it contains assumptions in reference to the same depth of water, which are not shown by the evidence in this case to be fact.

A. I don't know, sir; I have not examined the 1886 record. I cannot answer offhand as to what the gauge reading would be at Riverside in order to have 20 inches of water in the river. You will have to wait until tomorrow. I
1631 cannot state without examining the record as to whether it is true that at no time from the 25th of May throughout that entire year a boat such as I have described, carrying supplies and crew and eight tons, could have passed down that river on any given day. I did not testify on my direct that in preparation for testifying as to the depths and navigability of this river I made an examination of the tables for the purpose of determining the consecutive periods when the necessary stages of water would exist in the river as shown by the gauge readings at Riverside. I did make a casual examination, but not for the purposes of record. Only in a casual way did I make any examination for the purpose of determining the regularity of the return of periods when conditions would exist in the river as shown by the Riverside gauge which would enable the carrying on of
1632 navigation such as I have described. In a general way I am able to state what the result of my casual investigation was. There is generally a period of good stages of water

following the opening of spring and through the spring months and during May and June, especially if there be the ordinary amount of rain in those months, and frequently during the equinoctial period in the fall, that being September and October, when good stages of water prevail. I have assumed, and stated, I think, in my direct testimony, that a water navigation that would give 15 inches of water would
be a good boating stage for the early conditions. The
1633 reading of the gauge when you had 15 inches of water
would be about 13 feet, and 600 second feet at Riverside. At this stage there might be a deficiency of two or three points. The low water formerly read 11.4. Assuming that this table is made on the basis of 11.4 substantially, my 13 feet would be 1.6 over the weir below. I stated my recollection subject to correction that the width was something like 200 feet where the gauge was set. I have since corrected it. At a 4 foot stage it is about 150 or 160 feet. At a 2 foot stage it is something less, I cannot say how much less. I took the distance between the 15 foot contours which
are 4 feet above low water. Above that stage it spreads
1634 out quite widely over the bottom lands. That is about
the bank full stage at that point. I would not undertake to give the average width of the river below the gauge to Lockport. It varies very widely through the 12 mile level and varies considerably from the 12 mile level to Lockport. I would not undertake to say the narrowest width of the river below the Riverside gauge to Lockport. As to whether I know the narrowest width between that point and the mouth, I would say that I know that under natural conditions at Joliet there was a width of 120 feet. When I say under natural conditions, I refer to the period before any works were made or corrections made of the river at the point that I have in mind. That point was between McDonough street and Jefferson street. As to what was the width between Governor's Island, I will say I don't know the location of Governor's Island. As to whether it is my opinion that 1.6 on the gauge would produce 15 inches in the river between the gauge and Lockport I will say it would with a possible deficiency at the
Lemont Ripple and at the Romeo Ripple. The Lockport
1635 Ripple is all told about a mile, and there is less than a
mile at Romeo. As to whether it is my opinion that 13 feet on the gauge at Riverside would produce 15 inches from Lockport to the mouth, I will say there would be probably a de-

ficiency, possibly at Treat's Island, and near the mouth. By deficiency I mean less than 15 inches. As to how much less, I should want to look that up before I gave it. I don't know that I can look that up now; I prefer to look it up with the aid of my draughtsman who has got better eyes than I have.

I cannot sttae without going over the records as to whether it is a fact that 13 feet on the gauge at Riverside was not reached during September or October in 1886, 1887, 1888, 1889,
1890, 1892, 1893, 1894 and 1895. I presume that the tables
1636 are here. I have carefully studied them. As I stated in
reply to the former question, I have not gone into that consecutively. I do not know whether the same fact is true in September and October in 1897, 1898, 1899 and 1901.

Given a certain depth of water at a given point, the effect of doubling the cross section would depend a good deal on the shape of the cross section. The depth would vary between 5/8 and 3/4 in the doubled cross section of what it would be in the first assumed point. Assume that the cross sections were similar in form and of the same slope, and that the second was double the original cross section, it wouldn't cut the depth in two, because the width and depth are not
involved to the same power in a hydraulic formula. The
1637 explanation of that is, taking the quantity of water and
the slopes as identical, and the cross sections as similar in form, then the width multiplied by the three-halves power of the depth in the ordinary hydraulic formula would be constant. In other words the width would vary inversely as the three halves power of the depth. If you double the width the ratio would be expressed by one-half to the two-thirds power. Instead of doubling the original widths suppose you make it three times the original width, the relation of the depth in the channel as thus multiplied by three to the depth in the original channel would be expressed by the fraction of one-third raised to the two-thirds power. To figure it out,
the fraction would be 0.481 per cent. I figured there on
1638 vertical banks; it would be the same for a vertical sim-
ilar section. Assuming that channel to be enlarged four times instead of three, the depth in the enlarged channel as compared to the original channel, all other conditions remaining the same, would be 0.397 per cent. of the original depth. I mean that the depth in the enlarged channel would be 39.7 per cent of the original depth. Assume a depth of three feet in a given channel in which there is just suffi-

cient slope to produce discharge; increase that slope to five feet to the mile; as to what will be the relation of the depth of the water in the channel wherein that slope is assumed, as compared to the depth in the channel which has but
1639 slope enough to produce discharge, the volume being the same, I would say that I think you are assuming an impossible condition, because you must have some slope to start with, and I ought to know what that slope is. Assuming a slope of one-tenth of a foot to a mile, and increase that slope to 5.5 feet as against 0.1 of a foot slope per mile, the quantity of water and width remaining the same and the slope only varying, I would say you cannot produce those conditions and maintain your depth.

The relation of depth in the slope found of 5.5 as compared to the depth at 0.1 slope would be 0.263 per cent. of the depth in the channel with a slope of 0.1 feet. Assuming the same conditions as above, but instead of a slope of 5.5
1640 assuming a slope of 8.3 as against a slope of 0.1, all other conditions remaining the same, the depth in the latter slope would be 0.229 per cent. of the depth in the slope of 0.1. I want to say that these calculations are hastily made, and I will give the figures subject to correction.

The elevation at Kedzie avenue in the flood of 1892 was 9.36 and the elevation at Hoyne avenue in the flood of 1892 was 8.09. I think the elevation is correctly shown on Parry Exhibit No. 2 at Western avenue in the flood of that year.
1641 Before giving my answer I have examined the profile. It looks systematic with the other elevations. There is a record of these readings in the Sanitary District. They were made by an engineering party of the Sanitary District following the flood of 1892. The flood discharge of the Desplaines river passing Riverside gauge was 12,100 second feet. The proportion of that flowing toward Chicago was 7,700 second feet. The proportion that would have flowed toward Chicago in a state of nature before any work had been done by man there was 7,700 second feet approximately. As to whether I ever made a personal inspection of the cross section of the divide at Robey street, I would say, you mean on Kedzie near Robey, there is no divide near Robey. I do not recall that I ever examined the original cross section at Robey street. As to whether I ever made an examination of the maps prior to 1850 showing the cross section at
1642 Robey street, I would say I have examined maps prior to 1850, but I do not remember any map that gave a

cross section at that point. As to whether it is not important to determine what the cross section was in a state of nature in determining the conditions existing in 1892, I would say, a cross section of the Chicago river and a map showing its width and depth and all the hydraulic elements in it, would be extremely valuable. As to whether it would not be essential in order to make a probable flood line which would be of any value, I would say, I don't think you could make an accurate determination, and we can only use the knowledge that we have in a negative way. For instance, we know that the Chicago river has been greatly enlarged and that the flood line is necessarily much higher under natural conditions than under existing conditions. The Chicago river at Robey street has been greatly enlarged over what existed in a state of nature, it has been widened and deepened. In making that statement, I am speaking of the river generally, and would not speak specifically at a point because there might be a wide place and a low one, but the river generally has been widened and generally deepened. The most
1643 congested point is not the controlling point in the river so far as elevations are concerned. They might contribute more to elevation than some others of the points, but they do not control the elevation. I mean by "contribute more than some other points" that the greater the congestion the greater the effect upon the elevation, but it is the controlling element as a whole that determines the matter.

If it should appear that the cross section at Robey street was greater in a state of nature than in 1892, then the probable flood line in a state of nature would not be below instead of above the line of 1892. The probable flood line would be below the line of 1892 if in a state of nature the river was larger and deeper all the way to the lake, but not at a particular point.

As to whether in directing this probable flood line to be made upon the map, I proceeded upon the assumption that the river was wider and deeper at Robey street than in a state of nature, I would say that I did not limit my consideration to Robey street, but did have in mind the general condition of the river as compared to the present condi-
1644 tion. That was a part of the consideration.

As to whether without regard to the conditions existing east of Robey street and between that and the lake, the conditions existing at Robey street as to depth and width

would affect all the water back of it to the west, I would say, it would not by itself. You consider that apart from the whole channel. It would have an effect like any section of the river has an effect in proportion to its hydraulic elements. If the water proceeding from a broader cross section should come into a more contracted cross section, as to whether it would not necessarily from the fact that this same water had to pass through this congested point affect the elevation of the water back of it, I would say, it would steepen the slope through the congested section, and thereby elevate the water behind. The assumed original bottom in Parry Exhibit No. 2 is assumed as having existed prior to the changes made by the improvements to the river, that is in a state of nature. The first improvements in point of time affecting the original bottom I believe were made in connection
1645 with the Walker subdivision and following that, but the time I cannot state. It is since the Civil War. I have had no occasion to look it up.

This probable flood line is the assumed probable flood line which the high water of 1892 would have had, had conditions remained in a state of nature, that is the assumption. I would state in that connection that the part which is particularly important in connection with that flood line is at the divide itself.

Q. Would it not be rather important to know what the condition was on the east side of the divide, if you were considering the question of boats passing over it from the Chicago river?

A. I think we have evidence on that point which is conclusive.

Motion to strike out the answer as not responsive to the question.

A. Within certain limits it is of importance.

1646 Referring to the testimony of the record where I state that I designed and prepared the specifications and supervised the contract for a fleet of boats for the Missouri estimated at $500,000 worth, those boats were built in 1884 for use at all points on the Missouri river where work was going on from Yankton to the mouth; they were to be used in the government's operations and not for commerce. I did not have anything to do with the construction of them.

1647 In designing and preparing the specifications for them I had the assistance of a ship carpenter who acted as an

inspector later for the office. Prior to this time I designed and constructed a fleet at Nebraska City and also one at St. Charles, Missouri. They were designed in 1878, 1879, 1881 and 1882.

I have testified that the highest known water of record on the Riverside gauge occurred April 21, 1881, and was referred to the Riverside gauge which was subsequently established, and would establish on that gauge 21.6 feet. I made the mark on which the computation was based upon which they referred that high water to the Riverside gauge.
1648 I meant to say that I gathered up the high water marks, made the computation as to the volume and determined the equivalent of the Riverside gauge, referring the flood to that level. As to who made the mark showing the elevation at that time, at Riverside, I would say there are a number of marks of that and other floods which we gathered at that time, in 1886 and 1887. As to who, if I know, made the marks on which I arrived at the elevation of the flood of April, 1881, I would say that I do not know now, I do not recall.

As to what personal knowledge I had as to the accuracy of that mark, I would say, I satisfied myself at the time that the marks were correct, that the elevation I had estab-
1649 lished was correct. I did then know who made them. I do not now know who made them. It is recorded in the note books of that time. The note books were turned over as part of the records of the Drainage and Water Supply Commission to the Sanitary District. I prepared the note books originally; then that which I took from the note book was that which I placed on the note book.

In stating that the flood of 1887 which culminated at Riverside on February 9 was a notable flood, reaching an elevation of 20.22 feet and a volume of 10,324 feet, I got the figure 20.22 from our gauge which was established at that time. As to whether that is the highest gauge reading at that time, I will say I don't recall what is in the report of 1905 in that particular. I will state, however, that the figure given is correct, 20.22, and represents the stages of water that prevailed while the measurement was being made. Orig-
1650 inally the measure came from the files of the Sanitary District or files of the Drainage and Water Supply Commission. I have it as a memorandum in my possession.

As to whether there were made any readings independent of those made and recorded as gauge readings which appear in the report of 1905, I would say, I don't know of any readings except for local purposes that were made except those taken on the gauge after the gauge was established. I wish to say in explanation that the government record probably records only one reading a day, whereas the Riverside gauge reports two.

I have compared the flood of 1881 with the flood of 1892, I stated that the highest known water occurred April 21, 1881, and it was 21.6 feet. The record represents me as stating that the flood reached an elevation of 21.95 feet. That should be 20.95. The average in 1881 of the flood was greater than the flood of 1892. The flood of 1881 had a flood
1651 volume of 13,500 feet, whereas the flood of 1892 had a flood volume of 12,100 feet. The elevation of 20.95 in the flood of 1892 obtained but one day. As to whether the river fell between two and three feet the next day, I will say I don't recall the record in that respect. I could not state whether within less than a week it had fallen to 13½ feet.

As to how I arrived at the volume of 6,560 second feet April 21, 1881, at Joliet, I would say, I don't know that I have the records in my possession. It was a part of the official record of the Drainage and Water Supply Commission, and should be among that collection in the Sanitary District. I only have the result. I made a computation myself originally.

As to whether I am able to state the factors that I took and the steps that I took in arriving at that conclusion, giving the figures, I will say, I cannot give the figures; I can state the process and result. I have the figures in my office
1652 respecting the flood of 1892. That is shown on the profiles, the elevations above the several dams.

I cannot give the figures that were used to arrive at my conclusions as to the flood in 1887 without refreshing my memory. I can give the process. The flood marks were obtained for the year 1881. In 1887 we had actual gauge at Joliet on which we were keeping a record when that flood passed as I recall it. We took the height on the dam, the length on the dam, and I made certain observations for measurement of the flow of water in the river in order to establish the coefficient of the dam or correct the one that we had assumed. With that and the height on the dam, we could

determine the passage over the dam. There was added to that passage an estimate of the water being used by the wheels and also of the water in the case of dam No. 2, and also the water being used by the canal at that time, which made the total passing dam No. 2. These results were checked by means of Adams' Dam, the height upon which we had
obtained, and also by means of dam No. 1 upon which
1653 we also had the height of the water. Measurements
were actually made above dam No. 2, and the gauge was at dam No. 2 on the lock. Those results were applied to the marks for the flood of 1881, and in that way the flood of 1881 was estimated. I am not able to state how much water I estimated for the wheels. I am not able to state how much water I estimated was used for the canal.

Whereupon counsel for defendant moved to strike out the evidence of the witness as to the volume in these several floods, 1881, 1887 and 1892, as being hearsay computations or deductions from figures not produced and not in evidence in the case and which counsel for the defendant have no opportunity to examine.

The WITNESS continuing: I testified that under the conditions of the water that existed in the high water of 1892 and in the absence of bridges and dams at Joliet and Lockport, a steamboat drawing three feet of water could have passed from the Chicago river down to Lake Joliet and returned without difficulty. My answer is based on that flood line shown on the profile of 1892 which showed the extreme elevation of water in that flood. How long it existed I cannot say. The records show as to when the crest of the
1654 flood passed. As to whether if such a thing happened
at all it could only have happened at the crest of the flood, I would say that at a limit of three feet it would have taken place at the top of the flood.

When I saw that the low water of 1883 has been the official low water since used on all the surveys, I mean by the expression "the official low water" that it is adopted as the low water stage on the maps and exhibits since made. There is lower water recorded since that year at Morris, Illinois. Morris is nine miles below the mouth of the Desplaines river. I could not say what year was the lowest stage of water recorded at Morris without consulting the records or looking it up. The record at Morris will show, and I think it is printed in the report of 1905.

I do not recall that Wisner in the report of 1884, stated that the amount of water which passes dam No. 1 at Joliet at a low stage is about 39,000 cubic feet per minute. I do not know at that time what was the amount of water that the canal was bringing down and turning into the river above Joliet.

1655 Q. Was it not about 40,000 cubic feet per minute?

Objected to as not proper cross-examination.

A. I am unable to say without looking the matter up and I do not know that a record actually exists as to how much water was running at that time.

As to whether there is any source that I know of from which the information could be obtained, I will say there is only one way in which it could be obtained approximately, that is to take the rating curve which I made in 1886 and 1887 and which the canal authorities adopted for the flow of water in the canal based on the elevation of the water at Bridgeport, and take the monthly records of lake levels of Lake Michigan which would give the elevation of the lake above Chicago datum for each month, the average for each month.

In giving the slopes I have stated that at Treat's Island the slope was 9.55 feet in about one and one-quarter miles. As to whether as a matter of fact it is not 9.5 feet in 1⅛ miles, I would say that I think the statement that I made in the table of 1¼ miles is correct. I stated at the mouth the fall is 3.3 feet in about six-tenths of a mile. As to whether as a matter of fact it is not 3.5 feet in five-tenths of a mile I will say, not as I recall it.

1656 As to whether it is not true that most of the fall at Treat's Island is concentrated at the head and foot of the island, I would say there is a concentrated slope at these points. I do not recall what proportion of the fall is in these concentrated points or nips. The average fall for the distance between dam No. 1 and the mouth of the river is 2½ feet per mile. This is made up of pools and rapids. A boat navigates on actual slopes and not on average slopes. It is true the intervening pools would be useful in bringing down the fall, but they would not help the boat over the rapids; but it is quite usual to state the general fall of a stream as well as the detail of its slopes.

The fall from the head of Lake Joliet to the mouth of the river is 16 feet in a distance of 12.73 miles. That fall actually occurs within a distance of about three miles. The fall in

Lake Joliet included in the distance of 12.73 miles is only two-tenths of a foot, and that lake is between 5½ and 6 miles long.

1657 Near Jackson's creek at the foot of Treat's Island there is a steeper declivity than above and below. If I used the word "rapids" in saying there was a rapid near Jackson's creek, I used it improperly. It is not a rapid. I did not use the word "rapid," I used the word "fall" and there is a fall between that and the head of Lake DuPage. The fall is irregularly distributed over that distance, and you speak of fall as representing the total declivity between the two extreme points. The 6/10 of a foot in 1.1 mile applies to the pool immediately below Treat's Island and down in the vicinity of Jackson's creek. Between that point and the head of Lake DuPage there is a declivity the amount of which I do not recall. It is given in the table and shown on the profile.

1658 In the pool near Jackson creek at the front of Treat's Island, in a mile and one-tenth below Treat's Island, that is, from the foot of Treat's Island to a point 1.1 mile below Treat's Island, there is a fall of 0.6 foot. As to what is the fall from Jackson's creek to the head of Lake DuPage, the table will show: I do not recall the figures. The table shows 3.14 feet, and that is probably correct. I still consider my former answer of 0.6 correct for the 1.1 mile below Treat's Island through the poor.

Whereupon counsel for the defendant called attention to the table on page 1472 to the foot of Lake DuPage under the first column "Distance between point. Feet. 5,027 feet."

The witness states: As to whether that is correct, I would like to look at the table as the typewriter put it up. As the typewriter put it up, the original table was correct, and I have had it compared, but not myself personally.

1659 (After examining table.) That is a typographical error; it should be 15027 feet.

Whereupon counsel for the government asked leave to make the correction in the place where the table was originally introduced, so as to make it read 15,027 feet.

The WITNESS (continuing): Referring to my testimony as to the report of the survey for the 14 foot waterway, document 263, where I refer to the Channehon wicket type, in which I say that these dams being removed at times when the stages of water are sufficient to produce navigation without their aid as to whether they were designed to be lowered

at the beginning of winter to avoid damage from ice and to remain down until after the spring floods; that they would then be partly raised and ordinarily would be partly or entirely raised throughout the season of navigation, the only exception being when a flood occurred at rare intervals subsequent to the spring flood, as in 1892 or 1894, I would say that was not their purpose. I do not recall any statement to that effect in the official report. I can see how it might be done incidentally.

1661 The WITNESS. I want to state before we start that in that first calculation I made the other days where I gave 4.4, it should be 0.48. The others check out all right. I don't know what page that correction will be on; I just saved my memorandum. That is the only correction I have to make unless it is in the statement in regard to the ⅝ and ¾. The answer is correct if I understood the meaning of the question correctly.

Thereupon counsel for the government asked that the question be read, the question being:

Q. Do you mean that the depth would be ⅝ and ¾ in the doubled cross section, of what it would be in the first assumed point?

A. No, I did not mean that. I thought the question was a preliminary question and directed at the quantity of water that would pass in a given cross section at different stages.

Q. The question upon which the question I last read you was predicated was this: "Given a certain depth at a certain point, what effect upon the depth of that water would it have to double the cross section," the volume remaining constant; and if the answer ⅝ and ¾ is not correct, with that understanding of the question, I wish you would give the answer as you would now with that understanding of the question give it.

A. I had in mind the variation in depth due to the variation of quantity in the same section which is—

Mr. CRESSY. Just a moment: I am going to ask you to drop out the part of your question which you put in, "the volume remaining constant." That was not in the original question.

Mr. SCOTT. But I have read to him the original question and I have now endeavored to make it clear to him that in the case I assumed it was intended that the volume should remain constant, and I want his result on that hypothesis.

A. The figures that I gave later were based on a constant

volume as you stated. When I answered the other ques-
1663 tion I did not catch the idea of the volume being constant.

Q. I wish now you would give the depth in answer to that question with the additional assumption that the volume is constant.

A. That is the way in which the question was later answered, that with a constant volume and similar sections the ratio would be as I have expressed it in the answers to the following questions.

The WITNESS (continuing): The following questions assumed not the doubling of the width, but making it three or four times the original width. The result in figures for the double width would be slightly less than 0.63.

The natural and original watershed of the Desplaines river was 1428 square miles. The present watershed is 1392 square miles. 633 square miles of the watershed lies above Riverside. Between Hickory creek and Riverside there is 340 square miles including Hickory creek, or 209 square
1664 miles excluding Hickory creek. That is the original area. Including Hickory creek basin down to the mouth of the river there is 586 square miles on the present area, and the same on the original area.

I have testified as to a number of causes of depletion of the Desplaines river. The depletions which affect the area above the Riverside gauge and at the Riverside gauge are those that relate to the cutting away of forests and the drainage of lands, curtailment of lakes and ponds, effects of inhabitation generally. The other sources of depletion to which
1665 I have referred do not affect the conditions at and above Riverside.

As to whether I have taken into account in any of my estimates the contributions to the streams by reason of inhabitation, I will say, I have considered that matter; not in this connection. I have allowed nothing in my computations for contributions from inhabitation.

As to what sources of contribution there are to the river due to inhabitation, I will say, artesian wells are the only ones I know of. I have not computed the population in the basin of the Desplaines watershed since 1888 or 1889. I don't know what the population is below the Riverside gauge; I do not know at the present time what it is above the Riverside gauge. As to what it was in 1888 I could not tell without looking it up.

The Desplaines river is the run-off or outlet for the water

supplies and sewage of the towns on the Desplaines river above Riverside. As to whether it includes Riverside, I would say the Riverside sewer discharges below the
1666 gauge into the Desplaines river. Every town in the Desplaines basin, so far as it has a sewage system, discharges into the Desplaines river its water or sewage. As to what sources they supply that water from, I would say I do not know except as to Riverside, where they have artesian wells. I don't know what the population of Riverside is approximately.

The discharge in cubic feet per second when the gauge at Riverside stands at one foot or 12.4 on the gauge, is 305 feet I think. I cannot state offhand what would be the discharge in cubic feet when the gauge stood at 13.4. I could not figure that without the tabular statement of the gauge equivalents.

I do not think that these discharges at given elevations
1667 are printed in published reports. I will compute them for you, and at another session give you the discharges in cubic feet per second at 13.4, 14.4, 15.4 and 16.4.

The character of the soil in the Desplaines watershed from Riverside down is largely of impermeable clay below the surface soil except as there may be accumulations of muck in the low-lying area. There is very little permeable ground except on the DuPage river, where there is considerable.

The DuPage river enters the Desplaines river four miles from the mouth. In the Desplaines, from Summit to the mouth of the DuPage, there are not any swamps or marshes at the present time that I know of. As to whether there ever were any at any time that I know of, I would reply, yes, the whole region from the original divide down to the 12 mile level was a morass, also the Sag and the Flag creek country, and there was more or less marsh on the tributary streams.

I testified in the state's case that has been referred to here.

I believe I testified there in a state of nature there was
1668 a large swamp control on the Summit which reached the Desplaines river at Summit and in the Portage swamps and in the 12 mile level. I further testified that in the river below the 12 mile level there were not swamps which were feeding sources in the sense that they were usable in the neighborhood of Summit as a feeding source.

I was asked "Are they feeding sources for the Desplaines river?" and I answered "They are feeding sources only in the sense that every swamp or every bottom land over which floods gather and later run out, prolong a flood." I was then

asked: "Are they feeding sources in the sense that they are usable in the neighborhood of Summit as a feeding source?" and I answered, "No, sir."

Referring to the condition of the lower river, I was
1669 also asked, "Are they feeding sources for the Des-
plaines river?" "A. They are not swamps in the sense of the Kankakee swamp; they are swampy, marshy tracts." If the record in the state case so states, that is correct.

The supply for the lower river below Joliet, aside from what comes down from above Lockport and in a state of nature, was Hickory creek, the DuPage river, Jackson creek and Rock Run. I would not say definitely that these streams dry up in summer; I have never seen them dry.

As to whether these streams have impermeable sub-soils and are what may be called surface streams, I will say there is a limited amount of permeable ground on the DuPage river. Confining my answer then to the other rivers mentioned, I think the statement is substantially true that they are impermeable subsoils and might be called surface streams. It is true at the present time that they are all without swamp control.

As to whether I have any knowledge that it ever was a fact
that they had any swamp control, I would say, in regard
1670 to those streams, Hickory creek and Jackson creek, I
have no specific knowledge as to extended swamps but assume the usual proportion of such control as found to exist on local watersheds.

I wrote the pamphlet entitled "The Lakes and Gulf Waterway," "A brief with illustrations and notes published by the Citizens' Association. Prepared under the direction of Committee on Main Drainage. By L. E. Cooley, Civil Engineer, Chicago, January, 1888." The purpose of the pamphlet is expressed in the title and on the back page, as I remember it. It is an expression for the Peoria convention held in the year 1887, as I recall, and was originally written for the Executive Committee of the Peoria convention and printed by the Citizens' Association. The document just now shown me is a copy that publication.

Whereupon counsel for defendant asked to have said document marked for identification, whereupon said document was marked by the commissioner: "Defendant's Exhibit No. 1 for identification, Witness Cooley."

As to whether there is anything further that I wish to add

to my answer concerning this particular copy, I would
1671 say, it is of the first edition. The subsequent additions contained additional appendices. The only differences in the later edition were the additional appendices.

As to whether the Desplaines river below Riverside was a forest stream in a state of nature, I will say, it did not have the proportion of forests that existed above Riverside. I would not call the Desplaines river below Riverside a forest stream; it had a proportion of forests covering its surface.

As to whether it is not true that the lower Desplaines or the lower portion of the watershed had very little forest upon it in a state of nature, I would say, as I recall it, it had 1/3 to 1/4 its area in forests. I do not now recall at what points. I made a statement in regard to that in a report at one time, I believe, when I was familiar with the facts. I cannot indi-
cate any point in the lower Desplaines basins where
1672 there was any considerable forest. I cannot indicate any point on the Desplaines where there was any considerable forest below Riverside which is not standing today.

As to whether I do not recall that the early travelers described it as a stream flowing through prairies, I would say, as to a portion of it that was true. I cannot indicate, if it be the fact, any portion of the upper Desplaines river which was forested which is now deforested. As to whether it is a fact that the Desplaines river in the forested districts in the northern part of Cook County and Lake County still passes through that forest, I would say, I think not. I have not been along the river for several years, that is, the upper portion.

I did not write a work known as "Lakes to Gulf Water-
1673 way," published in 1906. I did write a work of that title in 1900 and printed in 1901. I did write a report by the Internal Improvement Commission of Illinois entitled "The Lakes to Gulf Waterway" in 1906.

As to whether or not I wrote that the Desplaines river above Joliet was a mere surface stream and went dry in summer, I would say, I do not remember the language. The mere surface stream phrase I frequently used in describing that portion of the river from Lemont down to Joliet. As to whether or not I further said that it went dry in summer, in substance, I may have said substantially dry. As to whether or not as a matter of fact it is true that I made the statement without any qualification such as indicated by the word "substantially," I would not say that without seeing the context.

1675 As to whether there were any additions to the natural volume of the river by reason of the construction of the Illinois and Michigan Canal meaning the volume below Riverside, beginning with the time when the canal was first constructed, I would say there were no additions to the volume of the river due to the original construction of the canal. The canal obtained its water from the Desplaines river, Calumet river, supplemented in dry seasons by a lift wheel at Bridgeport. As to when the lift wheel at Bridgeport was installed, I would say, that was contemporaneous with the construction of the canal. As to whether I know the volume of water supplied by that lift wheel, I would say, it was operated to supply the deficiencies in the canal, but I do not know the volume that was actually pumped by the wheel. I do not know what volume was contributed by the Calumet feeder. The Calumet was not by nature tributary to the Desplaines river.

1676 The Calumet feeder was constructed because there was not sufficient water to feed the canal on the Summit level in dry seasons. I mean by that the Desplaines itself in such seasons did not furnish an adequate supply of water for the canal. I don't know how much water was taken by the canal below Joliet to supply the canal at the time of its opening. I do not know how much was supplied to the river by reason of the Calumet feeder and the lift wheel. As to how I know, then that nothing was added to the volume of the river by the canal, I would say, for the reason that the volume furnished from these sources was not sufficient and necessitated the use of the DuPage river and the Kankakee river. The natural supply of water, and the increased supply by reason of the wheel and the Calumet were all used for the purposes of the canal.

1677 Q. As a matter of fact, there were certain rights which mills possessed, five mills possessed, to the uses of certain portions of the water which could not be diverted for use by the canal, is not that true?

Objected to as not proper cross-examination.

A. I have no information to that effect.

Q. Have you any information either way?

Objected to as not proper cross-examination.

A. Yes, I have. My information is to the effect that after 1859 or prior to 1859 the pumping station at Bridgeport was operated solely for the uses of the canal. That after 1859 the City of Chicago contributed in the winter time occa-

1679 sionally for sanitary purposes.

As to whether I have any knowledge as to whether there were any mills below Joliet or below the mouth of the canal outlet at Joliet which used the portion of the water which did not go down the canal, I would say, I don't know what the condition in regard to any mills may have been at that time.

Q. What is the earliest time of which you have any knowledge when mills were operated below that point by the water?

Objected to as not proper cross-examination.

A. There was a mill of some kind at the mouth of the river between 1837 and 1843.

Q. I am asking you after the construction of the canal. None of the questions has given any other time and for this purpose you may confine yourself to mills in Joliet below the mouth of the canal.

Objected to as not proper cross-examination.

A. What was known later as the Adams dam was in existence, I believe, at that time.

1680 The WITNESS (continuing): The Adams dam was above McDonough street, Joliet. That was below the mouth of the canal. I don't know as to whether its water was obtained solely from the river. I haven't any knowledge of its taking any water from the canal.

As to whether it is not true that before 1859 which I mentioned, at Dam No. 2 the water of the river was taken below the outlet of the canal for the operation of a mill upon the opposite side of the river, I will say I have no specific information on that point. My specific remembrance as to dam No. 2 goes back to 1885. It was there then. It was operated by means of a race on the east side of the river, that is on the side opposite to where the canal outlet was. I believe it

1681 was operated then by water power. I think the mill continued down to the time when the Sanitary District changed the conditions there, some time in the '90's; then the mill was taken and paid for by the Sanitary District.

Q. Were you familiar with the leases on the Channahon level of the canal in the City of Joliet?

Objected to as not proper cross-examination.

A. I have never seen the leases. I only know that water was used there.

Q. Do you know that water was used there for the operation of four mills on the level within the City of Joliet?

Objected to as not proper cross-examination.

A. I do not know the number. I do not know that sev-

1682 eral existed there that were so operated. I know that power was taken from a wheel that was installed on the Channahon level below Dam No. 2. I think there were two sites as I remember. I do not remember what was the size of them. They got their water from the Channahon level and the canal, and that water that it took from the canal discharged into the river. As to how early that condition existed, I don't know. My recollection is indistinct in regard to that further than the fact that I observed them probably as early as 1886 or 1887. As to whether I have any knowledge that that condition did not exist as far back as the opening of the canal, I would say I don't know.

Q. You have referred to a change that occurred in 1859. What was that change?

Objected to on the ground that the question was not complete.

A. On or subsequent to 1859 the City of Chicago in the season of the winter slaughtering at Chicago contributed in
1683 some degree to the operation of the pumping works at Bridgeport for sanitary reasons. That is all the change I know of prior to the canal deepening. By the canal deepening, I mean that the summit level of the canal under an Act of 1865 was cut down to the lake level on a declivity of 0.1 of a foot to the mile, so that the canal was fed directly from
1684 the Chicago river by gravity and that work was completed and put in operation in July, 1871. After the deep cut the amount of water that the canal contributed to the river depended altogether on the stage of water in the lake. As to whether it did not also depend on the operation of the pumps, I would say, the pumps were not installed until some time between 1883 and 1886. As to whether prior to the installation of the pumps, I can give any approximation of the amount of water carried after the deep cut, I would say, I do not know that any record exists, and it would have to be arrived at in some other way. I have at times given estimates of the flow. I did fix a rating scale for that purpose. I don't remember what estimates I have given of the flow after the deep cut. I would have to figure what volumes were carried after the deep cut. As to whether or not it carried at times as high as 40,000 feet per minute, I would say, that is about the volume that was stated at the time the canal was opened, 40,000 feet. I think it is the volume that I stated as hav-
1685 ing been carried at times, close to 40,000 feet per minute in 1871. As to whether I also stated that it got down

to 12,000 feet per minute or less at lower stages of the lake, I would say, the rating curve gives, as I remember, about 10,000 feet at Chicago datum. I think it is correct that I also stated that the range between 15,000 and 30,000 feet per minute had been a very ordinary range.

I don't know how much the canal took out below Joliet from the river per minute. I haven't ever had occasion to ascertain that. I don't know what proportion of the waters contributed by the deep cut went past the mouth of the canal at Joliet in the river and what part was diverted by the canal. As to whether I am in a position to say that the volume of the river was not added to by the canal after 1871, I would say, it depends altogether on the relative use of the canal below Joliet.

Q. There was a fixed maximum limit to the use of
1686 water by the canal below Joliet, was there not?

Objected to as not proper cross-examination, and further on the ground that the question is indefinite and uncertain.

A. That I cannot say.

As to whether I can say that there was a physical limitation governed by the dimensions of the canal, I would say,
1687 there was of course a limit beyond which the canal could not carry water. I do not know what that limit was. I know that the canal has been carrying water to feed it all the way to LaSalle.

Q. In addition to the limitation imposed by its dimensions, do you not know that there was a limitation depending upon rights acquired by certain lessees from the Canal Commissioners?

Objected to as not proper cross-examination, and as incompetent, immaterial and irrelevant.

A. The only thing I know about that is that after the deep cut was made the canal leases for water power were based on a flow of 24,000 feet of water in the canal which I take it was some medium stage of the lake.

Q. Do you not know that the canal commissioners were under obligation not to use more than 30,000 cubic feet a minute and that the riparian owners were entitled to the excess of water in the river above 30,000 cubic feet per minute?

Objected to as not proper cross-examination, and as
1688 incompetent, immaterial and irrelevant.

A. That I do not know. I have heard very often of the case of Druley against Adams, what is known as the Adams Dam case. As to whether or not I know that in that case it

was held by the Supreme Court that the mill owners had the right to the excess of the water above 30,000 cubic feet per minute, and that the Commissioners could not take more than 30,000 cubic feet per minute for the uses of the canal, I will say, I knew that a limit had been fixed of some kind, but I supposed that was a matter of agreement and not of court decision, and I did not know the amount.

Whereupon counsel for the government objected to the two previous questions referring to the suit of *Druley* v. *Adams* on the ground that they were not proper cross-examination, and for that reason moved to strike out the answers of the witness.

The WITNESS (continuing): I would not say that the canal's capacity below Joliet shrunk to much less than 30,000 feet per minute. I have no information as to the capacity of the canal having shrunk, nothing more than whatever deposits there might have been in the canal.

1689 As to whether I did not in the state's case say the canal in all the information of that period is supposed to have greatly shrunk in its capacity something much less than 30,000 feet, I would say, I do not remember that matter at all.

Q. If you did so state, can you now give any explanation of how you came to so state?

Objected to as not proper cross-examination.

A. I do not recall what the statement applies to.

I have stated, referring to the original wheel at Bridgeport, that it was used to supply the canal in very dry seasons. My information upon that point is from Mr. Ossian Guthrie. I got that information when I was engaged with the Drainage & Water Supply Commission. That was in 1886 and 1887. I gave the same testimony substantially in the state's case, that the pumping station was used only to supply water in very dry seasons. That is my recollection of the facts. As to whether at that time I was asked if I had any information upon which I based that statement, that that operation was for very

1690 dry seasons, and I answered "Not other than I have stated them," I will say that I do not recall how I answered at that time.

Q. I will ask you if this question was not put to you, and you did not give this answer: "Q. Have you any information upon which you base the statement that the operation was for very dry seasons," and did you not answer, "Not other than I have stated them"?

Objected to as not proper cross-examination.

A. I do not recall the context, Mr. Scott. I have no recollection of making that particular statement unqualifiedly. My impression is that Mr. Guthrie filed a statement with the Drainage and Water Supply Commission to that effect giving the log of the Bridgeport pumping station.

As to whether it is true that in giving my reasons for the information on which I based that statement I mentioned Mr. Ossian Guthrie or his log upon that trial, I will say, I think everything in the nature of hearsay was ruled out at that
1691 time. If I did not mention Mr. Ossian Guthrie in that connection, I forgot about it. It is true that a record was kept of the periods and length of time during which those pumps were used. As to whether I have examined the official report to see how much of the time they were kept in operation, I will say, I have never seen any such records, other than as I have stated on the authority of Mr. Guthrie. I do not know that such a record exists. My understanding was that there was no record except what Mr. Guthrie had retained in his log book and took with him at the time the pumping works became obsolete. I understood that there was a record in Mr. Guthrie's log book, and that he had possession of it.

In my testimony in the state case, this question was asked me: "You testified on your direct that resort was had to the pumps at Bridgeport to feed the canal in very dry seasons. A record was kept, was it not, of the periods, the length of time during which those pumps were used. Isn't that true?",
1692 and I answered "I presume that is true." I now presume it is true, but no such record have I been able to find at Lockport. I looked for that along about that time when we were investigating the subject in 1886 and 1887.

Q. Is it not true that those pumps were very commonly and generally operated to supply water?

Objected to as not proper cross-examination.

A. My information is limited to the statement which I have made which is contained, I think, in some of the city reports, that they did contribute to the pumping of water at Bridgeport when the river became bad in the winter time and during the season of winter slaughtering; but as to how long the contribution was or for how many years, or whether it was regular or not, I cannot say.

Q. Were you not asked in the state case this question: "Is it not a fact that they (referring to the pumps) were very commonly and generally operated to supply water"; and did you not answer, "I think that, in the latter period was true;

but I offer the explanation which I ventured in my previous question." Was not that question asked, and did you not so answer?

1693 Objected to as not proper cross-examination, and as incompetent, irrelevant and immaterial.

A. I do not recall. If it appears in the record that would be my best recollection at that time.

Whereupon counsel for the government requested that his objection stand to all this testimony without the necessity of repeating it after each question, which was agreed to by counsel for defendant.

The WITNESS (continuing): As to whether records were kept of these pumps from 1884 to 1887, I do not know of any. The pumps were tested late in 1886 and accepted by the city at that time. I made the preliminary test myself; the official test was made later in the autumn of 1886, I believe. I wrote a report of that test, I believe. I do not recall whether in January, 1888, I published a report written later in 1887 at which time I had the data of operations from the spring of 1884

1694 to the summer of 1887. I do not recall on what data I based the conclusion that I stated in that report. remember now that I made measurements in 1886 and 1887 and made a rating curve for the canal at Bridgeport, which was used, I said, as long as the pumping works were in operation.

As to whether on the trial of the state case, in answer to the question. "Q. You had at the time you wrote this the data of operation from the spring of 1884 to the summer of 1887, did you not?" I answered, "A. I presume I did," I would say that I think I must have had, in order to have made a statement connected with it. There was a gauge at Bridgeport. The rating curve which I had was also posted there at Bridgeport. I believe a record was kept. As to whether my conclusions were made up from the record. I would say, I am speaking now after the pumps were installed and in operation, and

I presume that my conclusions were made up from the

1695 gauge reports.

As to whether in that report I stated that from the spring of 1884 to the spring of 1887 the water pumped "has increased from 30,000 to 40,000 cubic feet to 60,000 cubic feet, the latter amount being sufficient to raise the natural flow at La Salle about 1¾ feet," I would say that statement was written in November, 1887, about that time, by me. The pumps were actually operating at 60,000 feet when I tested them. They were actually operated at 60,000 feet when the official test was

made in 1886, and they were operated for a time at about that rate. After the passage of the drainage law, or during that winter of 1889 and 1888, the pumps were thoroughly overhauled and operated for about three months at something over 50,000 feet, but that rate was not maintained subsequently, as I recall the operation of the pumping station after 1890. I used that addition to the volume of the Desplaines river from 30,000 to 60,000 feet, in giving the depths attained in the Illinois river at La Salle for the purpose of showing what the effect of the contribution of water from Lake Michigan
1696 would be upon the lower river. As to whether the statement was not what it would be, but what it has been, I would say that I do not recall without reading the report. I have not read that document for twenty years, so I cannot state off hand what I did say at that time.

As to whether I stated in that same article that from 1871 when the deep cut was completed to 1884, the canal carried by gravity to the Illinois river from 15,000 to 35,000 cubic feet per minute, I would say, I presume that is true.

Q. And you added "sufficient to raise the natural low water at La Salle from five inches to one foot, and half as much in the lower stretches of the river" did you not?

Whereupon counsel for the government stated that in addition to the objection which runs to all this testimony as not proper cross-examination and incompetent, irrelevant and immaterial, he desires to make the further objection that the witness is being interrogated concerning a document alleged to have been written by him without the document having been produced, which is the best evidence as to what the witness said in that document.

Whereupon counsel for the defendant stated that it had been produced and identified by the witness, and thereupon read:

"From 1871 when the deep cut was completed, to 1884, the canal carried by gravity to the Illinois river from
1697 15,000 to 35,000 cubic feet per minute, sufficient to raise the natural low water at La Salle from five inches to one foot, and half as much in the lower stretches of the river. From the spring of 1884 to the summer of 1887 the water pumped has increased from 30,000 and 40,000 cubic feet to 60,000, the latter amount being sufficient to raise the natural low water at La Salle about one and two-thirds feet."

The WITNESS continuing: I do not think there is any question about my having written that, but there is only one qualification to make to that. I think it is correct that I further state: "Even the operation of the present canal to its fullest capacity would raise the natural low water at La Salle about two feet and would doubtless make the projected seven feet possible without the locks and dams."

As to whether it is not then a necessary deduction that at this time when as I have stated the natural low water at La Salle was raised about 1⅔ feet, the canal was not being used to its fullest capacity, I would say, the rating of the capacity was usually made at 60,000 feet and is so stated in the Munn resolution. I had an idea at that time that the
1698 canal could be made to carry about 80,000 feet, but unhappily the Canal Commissioners said that the canal could not carry 60,000 feet and that rate was not maintained for any length of time.

As to whether when I wrote that pamphlet I recognized that the canal had added to the volume of water in the river below the mouth of the canal at Joliet, I would say, I do not know that I said anything about Joliet in the report. If the report states at page 33: "At Morris the water was so low (speaking of the season of 1887) as known for fifty years, notwithstanding that the flow in the canal was raised to 60,000 feet per minute or considerably in excess of former years. The low water discharge of the Illinois and the proportion of canal water is given in testimony referred to in Section 2, page 11, *et seq.*," I wrote it.
1699 Morris is between the inlet into the canal at Joliet and the mouth of the canal on the Illinois river.

Whereupon counsel for the government called attention to the fact that the words just read by counsel for the defendant were in fine print.

The WITNESS continuing: As to whether the statements made by me in this pamphlet which are in fine print are to be given any less weight than the statements made by me in the same pamphlet which are in larger print, I will say, if the statements are not made by somebody else's au-
1700 thority I should give to them the same weight. I don't know as to whether there is anything to indicate in this pamphlet that this particular statement is made by anybody else's authority. As a matter of fact the observation of the low water at Morris in 1887 was made by myself, and the observation as to the 60,000 cubic feet per minute being turned

in by the canal was also made by myself. That is the amount contributed by the pumps at Bridgeport. The amount is variable, however.

It is a necessary deduction that any addition of water to the river by reason of the flow in the canal which affected the volume of water at Morris must have affected the volume of water at every point between the inlet to the canal at
1701 Joliet and Morris. I don't recall what volume of water I found at Morris.

Whereupon the following extract was read into the record:

"The natural low water volume of the Illinois at Morris is nominal, not exceeding 250 to 350 second feet in 1887, practically at extreme low water, after allowing for canal water from Lake Michigan."

That is a correct statement, and I assume that I based
1702 that on the consideration of the date that I had. I didn't have any doubt about it when I wrote it. I don't know that I have any doubt now. I don't think I had any when I testified in the state case. I mean by the expression: "after allowing for canal water from Lake Michigan," deducting the amount of water that went through the I. & M. canal from Bridgeport and which remained in the river
1703 and passed beyond the inlet to the canal at Joliet, and that affected the volume and depth at Morris.

Q. In your pamphlet, the "Lakes and Gulf Waterway" of
1888, referred to and identified this morning as "Defendant's Exhibit No. 1, Witness Cooley," you stated, did
1704 you not, the following: "Effect on Illinois river. During a large part of the year the Illinois river is shallow, sluggish and at times stagnant and unhealthy and unfit for profitable navigation."

The question is objected to on the ground that it is not competent cross-examination, and on the further ground that it is incompetent, irrelevant and immaterial.

1705 The WITNESS. I did so state. My engagement at Beardstown in 1907 was in connection with litigation, that is, litigation followed it; I don't think anything had been instituted at that time. The work had not been done when I examined it. A mistake had been made by Mr. Harmon in the elevations and quantities contained in that embankment, but that was not a particular issue in the case as I remember it. I made no examination for determining that mistake.

Q. What was your examination for?

Objected to as not proper cross-examination.

1706 A. My examination was in regard to what had actually been done in the execution of a contract. As to whether litigation resulted with the contractor, I will say that proceedings were later instituted. The work was in controversy later. The examination was for the purpose stated, to see whether the work had been done according to the contract. The testimony was taken before a master, and my testimony was taken. And while you are on that subject, Mr. Scott, I should like to add that since 1907 I have been also employed on a board of engineers to design a waterworks for the City of Omaha, and also in the Carter case in regard to the works at Savannah, Georgia. In the Carter case my employment was to go over the records and the performance in that case and testify in the United States court on behalf of Mr. Carter. In connection with the Omaha water works, I was one of a board of three engineers to make plans and estimates for a new system of water works for the City of Omaha. As to what I did, I would say, I did what is

1707 usual in a board of that kind. As to whether I made any plans, I would say, Mr. Holman of St. Louis was employed to make the plan, and Mr. J. T. Fenning of Minneapolis, and myself, to act as consulting engineers in the premises. I did not make any plans personally. As to whether I prepared any estimates, I would say, I went over the estimates that were prepared, revising the estimates. My engagement lasted for several months.

Q. What was your compensation?

Objected to on the ground that the matter of compensation in that suit could have no bearing whatever upon the issues of this case, and the witness is not obliged to disclose matters which are purely personal to himself.

1708 Whereupon the witness declined to answer the question on the advice of counsel for the United States, who explained his position as follows:

The witness stated to me that he objected to disclosing these matters unless he was obliged to and asked me whether he must so state them, and I have stated that I did not feel that he was obliged to.

1709 Those waterworks were not built. In my direct examination (page 1496) I referred to the profile record

reported by General Wilson in 1867, and said "This profile is the Preston profile made in 1858 by John B. Preston." That statement is correct to the best of my knowledge and belief. I got my information from two sources; one
1710 is the evidence on the profile and in the report of General Wilson himself, and the other was a statement made to me by parties who were familiar with the canal at that time. The evidence on the profile itself is the legend "Survey of the Illinois and Michigan Canal, 1863," which applies only to the Summit level of the canal. The blue print of the original map on file in the state case shows that the diagram of the canal extended to La Salle and this legend applied to the canal from Lockport to La Salle from which it is to be inferred that in reducing the map for publication that portion of the canal below the City of Joliet was omitted, but the legend left as on the original map.

As to whether there is anything that indicates that the map was not made from a survey made in 1866, I would say, the statements in the report itself bear on that. There
1711 is nothing else on the profile itself. As to what is there that indicates that it was the profile of 1857 and not the result of a survey made in 1866 or 1867, I would answer, take the profile in conjunction with the report. The two have to be taken together. The report mentions surveys only made by S. T. Abert below La Salle, that is the report of General Wilson of 1867, and refers to that in two or three paragraphs; and also in Mr. Abert's report wherein it is stated that Mr. Abert used the profile of John B. Preston in preparing his own profile below the City of La Salle. Mr. Wilson did not make any survey between the City of La Salle and the City of Joliet. Mr. Wilson does state that he learned of the maps and data of John B. Preston on file at Lockport, that he paid a personal visit to Governor Oglesby and solicited the purchase of them for the use of the United States, and that Governor Oglesby complied, and that these matters were turned over to him. There is no evidence whatever in the report of any survey of the upper Illinois river in-
1712 cluding the Desplaines river between Joliet and La Salle, but General Wilson does state that the procurement of these documents enables him to make a report on the whole subject matter. General Wilson states: "A detailed report of the results of the resurvey of the Illinois river during the latter part of 1866, under the direction of Brevet Major General J. H. Wilson, was made on the 17th of

February, 1867, but as his operations were confined to that part of the river below La Salle, it was thought necessary to continue the surveys to Lake Michigan by all the possible routes, before absolutely fixing the details of the plan of improvement. Accordingly at as early a date as the season would permit, we organized, under the general authority heretofore cited, three surveying parties under the immediate supervision of Civil Engineer Assistant James Worrall, for the purpose of making a thorough and exhaustive examination of the entire region lying between the southern and western end of Lake Michigan and La Salle on the Illinois river, and also for the purpose of conducting a low-water survey of the river from La Salle to its mouth. To the first of these parties, under Civil Engineer Assistant George Butler Griffin, and afterwards under Civil Engineer Assistant H. Alppers, was assigned the duty of surveying the line of
1713 the canal from Chicago to La Salle, the Desplaines, and the Illinois rivers, and all the alternate lines which had at any time been spoken of, including that of Mud Lake."

That is in the report of 1868, and not in the report of 1867. The report of December 17, 1867, is not what we call the report of 1867. The point which I make is this: the portion just quoted is in a subsequent report known as the report of 1868, and not in General Wilson's report in which the profile is published. There is no profile published in connection with the report of 1868 from which you have quoted. General Wilson transmitted the report on December 17, 1867. It was further stated in said report of December 17, 1867:

"During the summer we made a personal examination
1714 of the country comprehended in the survey, and have fully investigated all points of interest connected with the proposed system of navigation, and by the aid of the extensive and careful surveys made under our direction, together with the survey of last year made under the direction of General Wilson, that of Mr. J. B. Preston made in 1857, and fortunately for our investigations, the large mass of facts bearing upon the questions involved which had been accumulated during the last thirty years by Mr. Wm. Gooding, chief engineer of the Illinois and Michigan canal, we doubt not that all the necessary information has been obtained upon which to base a definite plan of improvement, to make a final and economical location of the general line of works, and to estimate their cost with a degree of accuracy not hitherto attainable."

That appears in the second report, but that is not the report which relates to this profile which was introduced here in evidence and published in the previous report. The report in which the profile was published was transmitted in the spring of 1867 as I remember it. I did not use
1715 the profile of 1867 in making up my profile. I have not given as one reason why I did not use it the extreme low water of that year.

As to whether I have stated in that connection that the profile of 1867 was a profile made in the year of extremely low water, namely, 1867, I would say that at the time I made that statement I supposed the profile was made in 1867. That statement was three years ago, on the trial of the state case, but on a critical examination I concluded that it was not made in 1867.

Q. Therefore any testimony you may have given as to the conditions when that profile was made prior to your testimony in this case, was based upon a misapprehension of the year in which it was made, is that correct?

A. Except as to this point, that the year 1867 was also a year of very low water.

Counsel for defendant moved to strike out the answer as not responsive to the question.

Question re-read.

A. In so far as the year is concerned, yes.

As to why I did not use the profile of 1867 in making
1716 my profile, I would say, it did not occur to me to use it. In the first place because the profile of 1883 had been adopted substantially as the low water basis since the date of that survey, and for the further reason that above the City of La Salle it has not been practicable to assign the level of that profile with any degree of exactitude. That profile showed lower water than the profile of 1883. If I used that profile in making my profile the depths of water would have been less undoubtedly. That profile was not nearer a state of nature than the profile of 1883.

As to whether the additions to the river by reason of the pumping at Bridgeport had been increased in 1883 over what they were in 1857, I would say there was no pumping at Bridgeport in 1883. The deep cut had been made in 1871. It had increased the volume in the river by whatever surplus there was over the consumption of the Illinois and Mich-
1717 igan canal below Joliet. There was undoubtedly more water in 1883 than there was in 1857. As to whether it

is not true then that the profile of 1857 more nearly approached a state of nature than the profile of 1883, I would say I think the profile of 1857 differs from a state of nature far more than the profile of 1883. I don't remember what the addition of water was in 1883. I am satisfied in 1857 there was a substantial depletion of the water and that that profile is probably much more too low than 1883 is too high, depending upon the first cause of depletion that I have testified to, namely, the consumption of water by the I. & M. Canal by which all the water has been substantially taken at low water. I do not know the exact amount of water sup-
1718 plied by the Calumet feeder and by the Desplaines river, and how much was taken out by the canal at Joliet. We have a right to presume that they used what was necessary, but we must recall in that connection that the Summit level had to feed water in opposite directions and a double supply had to be made. As to whether it is also true that in 1857 the amount of water which was added to the Desplaines river together with what belonged to it was sufficient to supply the canal and to operate the mills at Joliet, below the outlet of the canal, will say I am not informed upon the subject of the mills at Joliet at that time.

As to whether my statement that the conditions in 1857 were less like those in a state of nature than those in 1883, is a sheer assumption, I will say, I do not think so, for this reason, that it is stated, and I think you have quoted, that the low water in 1887 at Morris was as low as it had been for fifty years.

1719 Referring to the profile of 1867. I gave as another reason, referring back to my answer when I say one reason why I did not use the profile of 1867 was that because "above the City of La Salle it has not been practicable to assign the level of that profile with any degree of exactitude." The datum in that profile of 1867 is shown on the face of it. It is given as so many feet below the water of Lake Michigan; that is the low water of Lake Michigan in 1847. There is no difficulty at all in comparing that datum with the later surveys, none whatever. When we know
1720 the conditions we can make the adjustment perfectly, but the difficulty comes in here; some of the surveys have been referred to Hennepin Canal datum, which is 120 miles from Chicago, and the levels over that distance do not give the results with exactitude, and there have been constant corrections in the base level up to the time of the final precise

levels of 1905. As to whether the same trouble did not exist in 1883, I would say that the 1883 profile has been referred to the final base levels of the precise determinations; the bench marks that were used in 1883 were connected up with later bench marks in such a way that they could all be brought together, but there are no bench marks of 1867, so far as I know in the valley between Joliet and La Salle. There are no bench marks as to 1857 as far as I know. I have made an effort to ascertain this information, and in 1891 and 1892 I sent two parties through the Illinois valley to pick up high water marks and secure other data with instructions to secure
all the bench marks that could be found in regard to
1721 the older surveys. They did find, as I recollect, some
bench marks by which the low water of 1867 were identified below the City of La Salle, but none above. I sent parties between Chicago and Joliet; I ran levels down as far as the Kankakee. They did not pick up bench marks in that region of the low water of 1867 that I know of.

As to whether I wish to be understood that it is not possible from the profile of 1867 to determine the low water line of the Desplaines river at the time that profile was made, I will say not with absolute accuracy. I will state, however, for your information that we have used the profile of 1867 so-called, and have platted it as accurately as we could. I did that in 1909 in regard to the pool known as Lake Joliet and Lake Du Page, and also 1874 for the purpose of determining approximately how much deeper these pools were then than they were at that time, but we did not make any attempt to do that within half a foot. It was purely for the purpose of seeing what the bottom was in those dates as compared with later dates.

The profile of 1867 professes to show the depth of the water at Dresden Heights all the way up the river as far as
Joliet. As to whether it does do so, I will say, on the
1722 scale it is printed it is pretty difficult to measure it with
any degree of accuracy. The large depths can be taken approximately, but when it comes down to discrepancies of half a foot I am not able to do that. As to whether as a matter of fact I cannot ascertain the depths down to a tenth of a foot upon that profile, I will say I have not been able to do so. The profile shows a continuous line from La Salle to Joliet. The line shown there is from Mr. Abert's line of 1866 and not the Preston line. The profile of 1867 shows Abert's line of 1866 below La Salle and that profile shows

a line up to Joliet from La Salle. I thought you were speaking about the river below La Salle when you said mouth of the river.

1723 Speaking of the Desplaines river profile of 1867, which shows a continuous line all the way from the mouth of the Desplaines river up to the City of Joliet, that shows the depths of the river. That line is the result of the Preston survey of 1857 or 1858, stated in the report of 1867 as 1858, and in the report of 1868 as 1857. As to whether the Wilson report of 1867, referred to, says, "The river itself, except in floods is very shallow, being often reduced in dry seasons to a mere brook, discharging less than 1000 cubic feet of 1724 water per minute," which is in the report of 1868, dated December 17, 1867, I would say I believe there is such a statement in the report. I remember the statement in the same report, page 441: "This canal, from a point eight miles southwest of Chicago, follows the valley of the Des Plaines, a tributary of the Illinois, until it forms a junction with the Kankakee river, some 50 miles southwest of Chicago, below which the river is known upon the map as the Illinois. The latter name would have been more appropriate for the Kankakee above that point, as it is the main river, and Des Plaines, in low water, contributes a comparatively insignificant quantity to its volume."

As to whether the statement, "The Kankakee supplies water sufficient to make a good slackwater navigation; the Des Plaines of itself does not, and although the direction of the former was such that it was not probable that a favorable connection with Lake Michigan could be made through its channel, yet it was deemed advisable to determine that fact beyond cavil," is contained in that same report, I say it is.

1725 As to whether I understand these references that have just been called to my attention to be the condition of the river as ascertained by General Wilson from the mass of material to which he refers, including the investigation of its survey, the careful and extensive surveys made under his direction, the survey of 1866, Preston's of 1857, and as he says: "Fortunately for our investigation the large mass of facts bearing upon the questions involved, which had been accumulated during the last thirty years by Mr. William Goodwin, Chief Engineer of the Illinois and Michigan Canal," will say I understand the references to refer to the extreme low water of exceptional years. The reference, "the river

itself except in floods is very shallow," would not be
1726 covered by my statement. When he continues, "Being often reduced in dry seasons to a mere brook discharging less than 1000 cubic feet of water per minute," I should say in river parlance a river that got down to a mere brook once in six or eight years would be "Often." The conclusion then to be drawn is that the extreme low water occurred at intervals of a few years apart. It could not occur several times in one season. As to whether the Riverside gauge shows that very low water occurred several times in one year will say, I assume that General Wilson in speaking of it being a shallow river—I think he uses the same language in regard to the lower Illinois river below LaSalle, which gets to be exceedingly shallow at times.

1727 As to whether I know anywhere where General Wilson has spoken of the lower Illinois as "often being reduced in dry seasons to a mere brook discharging less than 1000 cubic feet of water per minute," I would say he has not used that specific language regarding the lower Illinois but he did refer to it as a stream that had less than 600 feet per second by actual measurement, and he did refer to it as having a low water period of sixty to ninety days and did refer to it as having depths of eighteen inches on its bars. Those statements were correct.

As to whether the net result of this is my opinion
1728 is when General Wilson gave this conclusion from this data extending over a period of thirty years, he gave a conclusion that was not justified by his data, I would say I think we are bound to construe a statement made by General Wilson or any other engineer as a rational statement under the circumstances in which it is made, and seek to justify it by any other known facts, and in justifying General Wilson's statement, I assume he was speaking of the conditions when the larger part of the water was utilized by the canal. That is the only way that I can rationalize his statement.

As to whether there is nothing in his statement containing any such qualification, I would say I do not think there is, but I do not know that this is significant. A man in generalizing on the subject does not necessarily put up all the qualifications because his report would be indeterminable.

Q. You have referred to General Wilson's report stating that the period of low water was from 60 to 90 days in the Illinois. In this same report he speaks of navigation having

been partially suspended on the river for practical purposes the year before for about five months, doesn't he?

Objected to, on the ground it is not proper cross-examination and that it is incompetent, immaterial and irrelevant.

1729 A. As I recall the report he states that in the extraordinary season last past the river was at low water for 150 days.

When he speaks of the "present" season in the report of December 17, 1867, I took that to be the season of 1867; possibly I may be wrong. Where he says, "The past season the navigation between La Salle and Peoria was almost suspended from the last of June to the close of navigation; and below this it was but little better. In fact, navigation was virtually suspended on the river for all practical purposes for about five months," I understand that to be the season of 1867, when the profile was alleged to be made. As to whether he says, "There has been scarcely a season since the canal was completed, 20 years ago, when there has not been a serious interruption of navigation, for a greater or less period, from
1730 low water in the river," I would say I think Wilson states the period from 60 to 90 days. When he says, "This uncertainty of river navigation has so seriously operated against the canal as to materially diminish its usefulness and revenue. In fact, instead of being a connecting link in our extensive chain of navigation, as it was designed to be, has become little more than a local work, accommodating the limited country along its borders," I think he states that as giving reasons why the river should be improved.

When he says that "the oppropriations for the canal were based upon the supposition that the Illinois below La Salle was a good navigable river, and this large expenditure for the construction of the present canal would secure good and cheap navigation between Lake Michigan and the Mississippi. Such is not the fact," on page 452 I think he makes that statement by way of an argument, but I question somewhat General Wilson's statement that that reason was not known at the time the canal was built.

1731 COUNSEL FOR DEFENDANT. Move to strike out the answer of the witness as not responsive to the question.

As to whether as a matter of fact, instead of the canal robbing the river of water in that dry season of 1867, about all the water there was was furnished by the canal, I would say

I think that the water that fed the canal in 1867 probably all passed down to La Salle and there entered the river.

As to whether as a matter of fact, all the water there was in 1867 in the Desplaines river, practically was supplied by the pumping works and Calumet feeder, I would add the Desplaines and Dupage rivers.

Q. Did not General Wilson say in his report, page 455, that the pumping works at Bridgeport and the Calumet feeder "have furnished the main supply from Chicago to Channahon, some 45 miles," during the present excessively dry season?

A. I suspect that is a correct statement, including the Desplaines river.

COUNSEL FOR DEFENDANT. Move to strike out "including the Desplaines river" as not responsive to the question.

1732 A. Then my answer would not be according to my conscience.

Q. The question is whether he said that, Mr. Cooley. There is no reference to your conscience.

A. My conscience is a factor in my answers.

I have testified that there is an absolute deficiency in the run-off, due to the clearing away of the forest covered area from one-third to one-fourth of the areas, or the substantial clearing away thereof. That statement is repeated from an official document which I prepared in 1888 and 1889 for the State Board of Health, and was the result of studies that I had made prior to that time. The statement is based on general knowledge and reputation.

As to whether I can refer you to any sources from which we can ascertain the fact, which are more definite than general reputation as to the fact that there has been a clearing away of the forest covered area, I would say I think you

1733 have got two statements confused. I said (quoting from page 1393 of the record) "There is an absolute deficiency in the run-off, due to the clearing away of the forest area, one-third to one-quarter of the area, or the

1734 substantial clearing away thereof." The statement is to the effect that originally one-third to one-half the area of the upper Desplaines was covered by forests and one-third to one-fourth of the lower Desplaines. As to whether there is any statement of mine in the direct to that effect will say that is what I thought I stated. I cannot make out my statement from page 1393 to be an intelligent answer. Do not make out what I meant by it as reported. I go on and

say: "Taking this at 40 per cent. of the original area and assuming that three-fourths of it had been removed, that deficiency would amount to about six-tenths of an inch over the whole basin, based on the run-off of 12 inches in depth, or about 5 per cent." The statement one-third to one-half of area was originally in forest, which I have taken at 40 per cent. and assume that three-quarters of that forty per cent. has been cleared away. I assume that from one-third to one-half was originally in forest.

As to whether I made any examination to ascertain how much of the original area was in forest, I would say that statement, as I have stated, is repeated from the report which I made to the State Board of Health in 1888 and 1889 and was based on an examination of the original maps and of
1735 the reports of the geological survey of Illinois. I am prepared to say that one-third to one-half of the original area as shown by the original survey was covered with forests, from my information as I stated it in 1888 and 1889. As to the statement that three-fourths of the forest had been removed, I have taken that from general reputation and my own limited observations.

The upper Desplaines basin contains 633 square miles. 40 per cent. of that would be 253 square miles, and three-quarters of that would be 190 square miles. As to whether I can refer to any data or source of information from which it appears that 190 square miles of the upper Desplaines basin has been denuded of forests which originally stood
1736 there, I would say the best authority on that is the statement I have made, to wit, three-quarters of it has been removed. As to whether I am speaking then *ex cathedra*, I would say that is my best information. I do not know of any actual survey that has been made to determine the actual area that is left in forests. I do not think I can catalogue my sources of information.

As to whether I know of any place in the upper Desplaines basis where 10 square miles of forests have been taken off, I would say I could not mention any specific spot. I could not indicate where any considerable amount of forest in the upper Desplaines basin has been removed without reproducing the maps. I do not know positive that there are maps which show the denudation of forests. The original surveys show where the forests were. I did consult those in arriving at the conclusion as to the original amount of forest in the

basis at the time I wrote that report which I have referred to.

1737 Q. If they should not accord with your conclusions here as stated in your testimony, do you know of any other data which could be referred to, to determine whether or not the survey was correct?

A. You refer now to the original areas?

Q. Yes.

Objected to, on the ground that you have not shown that those maps do not show there is.

Mr. MUNRO. We will show that a little later.

Mr. SCOTT. This is a hypothetical question.

COUNSEL FOR GOVERNMENT. Objected to, on the ground that it is a hypothetical question, and there is no evidence in the case to justify any such hypothesis.

A. I have mentioned two sources—the original land surveys and the geological report.

1738 Q. Assuming for the purposes of this question that they do not accord with your testimony, is there any other source which we could go to to determine which was correct?

Objected to, on the ground that it is a hypothetical question and there is no evidence in the case to justify any such hypothesis.

A. I think it would be a matter of extreme difficulty to reproduce the original forest conditions without those surveys and reports. I refer to the geological reports of the State of Illinois. There are a number of them, prior to 1860. I cannot state what year the data will be found in.

The area of the lower Desplaines is 795 square miles. The limits of it geographically are from Riverside to the mouth along the river and east of the original divide at Kedzie avenue and including the DuPage river, all the drainage to the Desplaines river below Riverside.

As to how many miles west the watershed would extend, I would say it extends to the general line on the north of the Desplaines river on the township line crossing the Desplaines river near its mouth.

1739 I did not use 40 per cent. or state that amount in regard to the lower Desplaines; when I said 40 per cent. of the original area was in forest and that three-quarters of it had been removed, that deficiency would amount to about 0.6 of an inch, I referred to basin above Riverside. The condition below Riverside was originally, as I recall it, one-

quarter to one-third in forest. Not so great as you go northward.

Q. What percentage would you take there?

Objected to, as not proper cross-examination.

A. I have not made any figures on that or testified in regard to that matter, so far as I know.

I think that all the authorities are agreed as to the effect of deforestation. There has been some difference of
1740 opinion, but I think there is a substantial concensus of opinion that the removal of the forest diminishes absolutely the amount of the run-off and affects the distribution still more. When I said that there was an absolute deficiency in the run-off due to the clearing away of the forest covered area, what I had in mind as to how the clearing away of the forest which caused an absolute deficiency in the run-off was the fact that forests consume less water than an open country. It leaves more to run away. I mean that a forest cover uses less water for the needs of growth of the forest or vegetation than open country in crops or grass land. If that be true, there would not be greater floods in a forest country than deforested country for the reason that the forests exercise a very large control in the run-off. Being asked if it is not true that in periods of extreme drought and in the periods of great precipitation the forests do not exercise a control over the run-offs that has either the effect of increasing the run-off or prolonging the stages of the rivers, will say the control can be exhausted in rare years and at long intervals on any watershed. For instance, a succession of dry years would entirely exhaust all the reservoirs and saturated grounds, and on rare occasions you would have water
1741 as low as you have habitually when these sources of control are destroyed. Again, on other rare occasions the control would be exceeded by the precipitation, and when that occurs you would have a flood which would be as great as you habitually have when there is no control. Floods are caused by long-continued and widespread and heavy precipitation.

As to whether at the times of long-continued widespread and heavy precipitation, the forest bed becomes completely saturated, its storage capacity becomes exhausted, and it has no more power to restrain floods than the open country itself, I would say that is true in those extreme and rare cases I have called attention to. It is not true that forests never diminish great floods or that they increase them somewhat.

As to whether there is any conflict with the opinion I have

just expressed, to my knowledge, I would say I think there is a great deal of unsettled thought in the matter, but so far as I know those who have given the matter profound study agree with the statement I made. Taking the dry seasons and
1742 times of drought, it is not true that at such times the forests lessen the run-off. It is not true that at such times the forests hold the water and often swallow it completely.

As to whether it is true that small showers that make a perceptible run-off in the open are often practically all absorbed in the leaves of trees in the forests. I would say that that has proved true in regions in which denudation has proved to be complete so that soil and everything else has gone on steep slopes. As to whether it is not true also in regions of different character than I have assumed in my answer, in regions such as surround the Desplaines river, I would say I do not think so as a general proposition.

As to whether it is true that heavier showers in times of drought that make freshets in the open, are largely absorbed in the leaves of trees and forest beds, and pass off in evaporation and never reach the streams, I would say I can conceive conditions where that might possibly be true, but not as a general proposition. It is not true that the evaporation from the forests under such conditions is greater than in the open country, and that the run-offs from the summer precipitation is less.

1743 As to whether it is true that the drainage of low swamp lands leads off into streams in dry weather waters that formerly remained in those swamps or passed off into evaporation, and that in such cases often the low water flow is greater than it used to be, I would say there is a possibility of such being the case in deeply permeable soils, but even those would run out in time. As to whether a large part of them in a continued dry weather pass away in evaporation and never reach the streams will say after the saturation of the soil is exhausted to a certain extent what remaining moisture is left does not run away; it passes off by evaporation or plant life.

As to whether that same water under similar conditions where there is no swamp or dry land, would not pass away in evaporation to the same extent, but would run into the rivers, I would say that might be true.

I am somewhat uncertain as to what the effect of inhabitation would be on the Kankakee region. As to whether it is

true that since the draining of the swamps there the low water conditions of the river (Kankakee) have not been as long as they were prior to the draining of the swamps, I would say that I stated in regard to that that I was not clear as to what the effect of inhabitation would be. I testified to a low water volume and other volumes that had existed in the Kankakee region due to swamp control. I did not testify that the water in that region was lower now and that the stages of water were more prolonged than before the swamp drainage. I have taken the position at one time that the effect of the drainage of the swamps of the Kankakee region would be disastrous on the Illinois river, the supply of water
1745 there. I have since had reason to believe that I may have been hasty in my conclusion, as the Kankakee region is underlaid with a considerable depth of sandy soil by which you can substitute the effect in part for a permeable watershed for the original swamp control. The action of a permeable watershed is somewhat different from swamp control. A swamp control prolongs the stages of water but when it is exhausted the water drops suddenly, whereas a permeable watershed does not have that sharp variation.

Q. You have said that you thought there was no considerable difference of opinion among persons competent to have an opinion upon the subject, I have been inquiring in regard to the effect of deforestation. Do you know Col. H. M. Chittenden of the United States Army?

A I do.

Among other things he has written a history of the Northwest fur trade. I believe he is lieutenant colonel in the Corps of Engineers in the United States Army.

Q. In that position he has had very large experience, has he not, with forests, streams, conservation of forests, continuance of water flow?

Objected to, on the ground it is not proper cross-examination, and on the further ground that no foundation has been laid.

A. Chittenden for some years has been in charge of the Yellow Stone Park region which is a part of the forestry service of the United States, the very purpose of which is to preserve the flow of streams, but I do not know what position Chittenden may have taken in regard to the matters about which you are asking.

Q. Are you aware that at a meeting of the American Society of Civil Engineers held November 4, 1908, he read a paper

entitled "Forests and Reservoirs in their relation to stream flow, with particular reference to navigable rivers," in which he took each of the positions stated by me in the several questions asked you in regard to the effect of deforestation?

Same objection.

1747 A. I do not know that paper. I know that there was such a paper but I have not read it.

1748 As to whether that paper was widely discussed, I will say there was considerable discussion.

I am a member of the American Society of Civil Engineers. I presume I received a copy of that paper before it was read, with a request to contribute to the discussion. As to whether I am aware that there was a very large discussion and papers read discussing Col. Chittenden's paper and his conclusions, I would say I have never gone over this discussion.

I do not know Robert Fletcher. I have heard of him. I do not know much about him. I do not remember the connection in which I knew his name. I think he is a member of the American Society of Civil Engineers. I think I knew that he agreed with Mr. Chittenden in all these conclusions. I would not say as to whether he is a man entitled to an opinion.

1749 I know J. P. Snow. I could not say what he is. I think he is an engineer and a member of the American Society of Civil Engineers. I do not know that he discussed that paper and agreed with the conclusion of Col. Chittenden.

I do not know Clarence T. Johnson. I know there is such a man. I do not think he is a member of the American Society of Civil Engineers, and that he is largely familiar with the forested mountain regions of the west. I do not know that he agreed with Col. Chittenden in his conclusions. I have not read that collection of papers.

1750 I know there is such a man as H. F. Labelle. I do not know what he is and presume he is a member of the American Society of Civil Engineers. I do not know where his work has largely been. I do not know that he has largely been in Susquehanna and Schuylkill water sheds. I do not know whether he is a man entitled to an opinion upon this subject.

Q. Do you know that he agrees with Col. Chittenden?

COUNSEL FOR GOVERNMENT. I object, on the ground that it is not cross-examination, and on the further ground, and this objection will apply to all the answers in which the witness has first stated that he does not know the man and then counsel for the defendant pressed the question as to whether he does

not agree with Mr. Chittenden without producing the book and without offering in evidence the various passages on which the questions are founded.

A. I do not.

1751 I do not know W. H. Leffingwell. I know there is such a man but I cannot place him at the moment. There is such an engineer. I have no doubt he is a member of the American Society of Civil Engineers.

I know there is such a man as A. M. Strong, an engineer. I would not say as to whether he is a member of the American Society of Civil Engineers.

Q. Do you know that both of these gentlemen from their investigations in the southern Sierras contributed to the same discussion, agreeing to the conclusions of Chittenden?

A. I do not know. I have not read, as I first stated, this collection of papers.

1752 I know there is such a man as Major William W. Hartz, U. S. Army; he belongs to the U. S. Engineer Corps, I believe. I do not know that he contributed to the same discussion.

I know there is such a man as A. Miller Todd. I do not know about him, about his occupation or profession. I presume he is a member of the American Society of Civil Engineers. I do not know as to whether or not he was intimately connected with the work of improvement and flood control on the lower Mississippi river for fifteen years prior to 1908. I do not know that he contributed to that discussion and agreed with Mr. Chittenden.

I know of Mr. F. B. Maltley. He is a member of the American Society of Civil Engineers. He was for many years United States Assistant Engineer in charge of 1753 dredge operations on the Mississippi below Cairo and subsequently at Panama. I know something of his work. He is a very capable engineer. I do not think he is especially entitled to an opinion on this subject. I do not know whether it is or is not true that the man we are now discussing, in the pursuit of his profession and the discharge of his official duties gave much time and observation to this question. I do not know that he did not.

As to whether he contributed to that discussion and stated that he agreed most emphatically with the author that the popular belief that deforestation is responsible for floods and low waters is an erroneous one, I would say I do not know that he made any such statement.

I should say there is such a man as L. J. LeConti. He is
a member of the American Society of Civil Engineers. I
1754 ought to know something about his work but I do not
recall it just now. The name is very familiar but I do not exactly place it. As to whether he is a man who in my judgment would be entitled to an opinion upon the subject, that I could not say from my recollection.

Q. Do you know that he gave it as his opinion in that same discussion that forests do not exercise any appreciable restraining influence on great river floods?

Objected to, on the ground not proper cross-examination, and on the further ground that the witness states he is not familiar with that set of papers.

A. I do not know that he made that statement.

I know Thomas P. Roberts. He was for a long time engineer for the Monongahela Navigation Company in Pennsylvania and in the employ of the United States, and for a long time United States Assistant Engineer in the Pittsburg office. As to whether he is an engineer of recognized ability and many
years of experience, I would say Mr. Roberts has a good
1755 reputation and entitled to express an opinion on this subject if he is so disposed. As to whether I know that he contributed to that discussion and agreed with Mr. Chittenden, and submitted tables dividing the records upon the Ohio river into two periods, 1855 to 1880, and 1881 to 1907, showing that the mean monthly lowest stages were from three-tenths of a foot to one foot lower during the earlier periods, I would say I remember Roberts' work upon the Ohio river in that particular but not in connection with this paper.

As to whether or not I know that the members of the American Society of Civil Engineers who contributed to the discussion of Chittenden's paper by written contributions, out of twenty-one who expressed opinions thirteen agreed with Chittenden, I would answer that I am unable to say, not having looked at the papers.

As to who first advanced this theory of the effect of deforestation, I would say that I think that is a sentiment like others that we cannot trace, that grew up from human experience. As to who first gave it general currency, that I cannot say any further than that for a century or more governments have been engaged in replacing forests on the theory that it affected stream flow, and are still engaged in doing the same.

As to whether it is not true that these opinions were
1756 first given general currency about 42 years ago by Sir Gustav Wex, chief engineer of the improvements on the Danube, I would say I have Mr. Wex's works and have read them. It was translated by General Weitzel. As to whether it was stoutly resisted by many representative engineers, and only found a limited acceptance in the profession in Europe, I would say I do not think that is true, and you have come to a point in which I wish to observe that your question and attitude in the matter is entirely too narrow. I do not think personally I disagree with Mr. Wex in regard to his deductions made from records at the iron gates of the Danube where he had a gauge record running back two hundred years or more. I do not think that I disagree with Mr. Roberts in regard to the great basin of the Ohio river, nor in regard to any one that may have expressed an opinion upon the floods of
1757 that region, but that does not go to the point. There might be absolute degradation of the surface and torrential conditions in all the local tributaries of a great stream without affecting the conditions that produce a common flood in a large basin. That is what I think occurs.

As to whether I assume that these gentlemen referred to are speaking of such happenings as I have mentioned in my statement, instead of giving their general conclusions on the subject, I would say I think the majority of them admit that the effect of deforestation on local basins and small areas is profound, but that the effect on great basins in the aggregate is not profound.

As to whether the fact that it was a small basin or a larger basin affected at all the evaporation of the small showers caught on the leaves of trees, I would say you are carrying the question to a point of attenuation. As to whether the fact that one basin was larger than another would affect the question of swamp control in so far as the prolongation of the low water stage is concerned, I would say, assuming all the conditions relatively the same, perhaps not.

1758 As to whether a good many of the data of phenomena upon which this opinion in regard to the effect of deforestation is based have been shown by subsequent phenomena not to have been affected at all by deforestation, I would say there is a disposition to attribute all the effects on a watershed to deforestation. I came to the conclusion twenty years ago and having stated it repeatedly that the effect of inhabitation on open and prairie country was beneficial so far as stream

supply was concerned. I call the Desplaines country semi-prairie country. I think it is not a good example of prairie country.

Q. Would you say that the effect on open and prairie country of inhabitation was beneficial so far as stream flow is concerned, but that in semi-prairie country it was not beneficial?

A. Clearing away the forests changes that condition to the extent of the influence of the forests.

COUNSEL FOR DEFENDANT. Move to strike out the answer as not being responsive to the question and ask that the question be reread.

A. It depends altogether on the character of the water-
1759 shed and soil. My statement was a general statement and not specific.

In my original testimony on direct in this case, I made the comparison between the run-off in the Kankakee basin and the run-off in the Desplaines basin, using the Kankakee as a standard of comparison of what would have occurred had original conditions continued to exist in the Desplaines river. I referred to the flood control exercised by the conditions in the Kankakee, but made no comparison, I think. I may have done so.

After questions on direct were reread the witness further answered:

1760 I did use the Kankakee as a basis for comparison, as throwing light upon the question as to the length of time in which the volume would have been prolonged if the state of nature had continued in the Desplaines river. I made the deduction that if the Desplaines had remained in a state of nature it would have continued at higher levels and for a longer periods. I am not prepared to state what, if any, effect drainage in the Kankakee swamp region has had upon the run-off or the stages of the river.

Q. Now, I wish to put some questions which were asked at one stage of the cross-examination and under objection of the attorney for the United States they were not then answered. I understand now that there is no objection to those questions being answered, or at least the witness will not be instructed that he need not answer.

I read now the question asked you on the 21st of February: "Q. What basis of compensation exists between you and the United States for the time given by you to this litigation?"

Here ensued colloquy as to whether the witness had a
1761 right as a matter of personal privilege to decline to answer this question.

1762 Mr. CRESSY. Counsel for the plaintiff, the United States, in this case are unwilling to direct you to answer or to advise you as to your personal rights in the matter; but we simply withdraw our direction to you not to answer, reserving our objection as to the question as to its not being proper cross-examination.

The WITNESS Personally I think it is a matter of privilege, but I do not care to be put in a false position by refusing to answer. Therefore I will answer, $50 per day. I have received from the United States for services in con-
1763 nection with this litigation $900. I do not know how much money is due me for this service in addition to the money already received. I was paid up to the first of July of last year. Then there is due me at the rate of $50 a day for all the time that I have put in on this case since the first of July
1764 last year. I cannot give an estimate of how many days I have put in. I received my compensation through the United States Attorney's office. I stated that my compensation for the state had been, as I remember, about $2000. I remember putting a bill to the Attorney General's office of $2500 and he cut it down $500 and that $2000 was all that I received through the Attorney General's office. I have stated that I was employed by International Improvement Commission of Illinois at that time as consulting engineer at $300 a month, in addition.

1765 Referring to Parry Exhibit 2 on which there is a line purporting to show the high water of 1892, these high water marks were determined by an engineering party of the Sanitary District, and are a part of the records of the Sanitary District. I think that Parry Exhibit 2 shows that all the observations recorded in connection with the high water of 1892 between Lake Michigan and the Desplaines river. There was not in the notes that I have of the high water in 1892 any record beyond the point where my "H. W. 1892" as it is marked upon this map terminates on the west at Robey street.

1766 There may be a record in the Chicago river for all I know.

As to whether I have examined to see whether Parry Exhibit 2 shows all the observations recorded as to the high water of 1892 in the Sanitary District records, as between the Chicago river and the Desplaines river, I would say I have not checked

it personally; I relied upon the draughtsman to make a careful interpretation of that. I think that in making the observations of that flood they started at Robey street and pursued their investigations down to Joliet. As to whether the Sanitary District made observations of the flood east of Robey street, my impression is there was a gauge along the canal and one or two along the river, but I had not looked them up. I am now referring to the Chicago river and the gauge was on
the canal lock of the Illinois and Michigan canal. I refer
1767 to the lock at the point at or near Ashland avenue.

COUNSEL FOR DEFENDANT. In addition to the objection which I made when this Parry Exhibit was introduced, and following it, I move to strike the document, Parry Exhibit No. 2, and all testimony concerning it, from the record unless the United States shall before the closing of its case produce in evidence in this case all the data with reference to the high water of 1892, upon which the high water line shown upon this map is predicated; and also the probable flood line shown on this map. I include herein not only such records as there may be as to the high water line west of Robey street, but whatever records there may be in the Sanitary District office as to the high water line of 1892, east of Robey street.

COUNSEL FOR GOVERNMENT. Do you want all that in the record or do you merely want an opportunity to check it yourself?

COUNSEL FOR DEFENDANT. If I have the opportunity of checking it I may not want it in the record. I will determine whether it goes in when it is submitted.

COUNSEL FOR GOVERNMENT. I just wanted to get your point.

Re-direct Examination.

1768 I was asked on cross-examination with reference to
the extreme height of the flood of 1892 at the Riverside gauge. I stated that that height was 20.95 feet. At page 1650, referring to House Document Number 263, being the report on the fourteen foot waterway, already in evidence in this case, page 514, I find a note at the foot of the gauge reading for 1892 where it says, referring to Note "A" to June 24th, "Gauge reading at ten P. M. was 21.35." The regular reading for June 24 was 20.55. That would alter my answer on cross-examination in reference to the extreme height of the flood of 1892. I stated that the volume of water at an elevation of 20.95 was 12,100 second feet. The volume at this amended

reading at ten P. M. June 24, at 21.35 feet would be 12,860 feet or thereabouts. This would not alter my answer on cross-examination that the flood of 1881 was greater than the flood of 1892. Referring to page 1651 of the cross-examination,
1769 part of the original data which I there referred to as having been used in preparing my answer as to the elevation of the flood of 1881, is given in the Water Supplies of Illinois, in this pamphlet now shown me, entitled "Preliminary Report to the Illinois State Board of Health. Water Supplies of Illinois and the Pollution of its Streams. By John H. Rauch, M. D., Secretary. With two Appendices." Appendix 2: "The Illinois River Basin in its Relation to Sanitary Engineering. By L. E. Cooley, C. E." Springfield, Illinois, 1889. That is the pamphlet that I referred to. I am the author of this appendix. The circumstances under which I prepared this appendix are as follows:

I was in the employ of the State Board of Health as consulting engineer in 1888 and 1889 and was charged with the duty of making up a digest of all the existing information regarding the Illinois river and its several tributaries. This is a preliminary report upon the subject matter as far as I had proceeded up to the time that the report was printed. Subsequent to that a good deal of additional data was col-
1770 lected for the purpose of amplifying and extending the report, particularly in 1901, when I was again in the employ of the State Board of Health, but never reached the point of publication.

In that later investigation which I made of the matters contained in this report I checked up so as to know whether those statements contained in this report were accurate and correct. There was no difference, except that in the material used in 1889 I used it in a preliminary way and it was not exhaustive with the matter in hand. There was additional material collected in 1901 also, and later by the Sanitary District.

As to whether in the preparation of this report I made an examination of the topographical condition, bench marks and other data in reference to the condition of the Desplaines river basin and the flow of the Desplaines river and floods and matters of that character, I would say I familiarized myself with all the sources of material that had been prepared concerning the Desplaines river and its basin, and in addition to my former studies for the Drainage and Water Supply Commis-

sion, made such excursions and trips in the Desplaines
1771 river valley as satisfied myself as to the substantial correctness of what was incorporated in the report.

Q. Are the statements contained in this report of 1889, to which we are referring, correct and accurate?

Objected to as incompetent, immaterial and irrelevant that the conclusion of the witness is not competent and that the correctness of the computations and figures cannot be established by testimony that they are as a whole or in wholesale or in gross correct.

A. They are.

Q. Referring, Mr. Cooley, to this article: "Illinois River Basin in its relation to Sanitary Engineering, by L. E. Cooley, C. E.," which commences on page 49 of this book, I will call you attention to a subdivision of that topic entitled "Effect of Inhabitation," which begins on page 55 and runs to the top of page 58. Have you examined these pages since the last adjournment?

A. I have.

Q. Are these pages 55, 56, 57 and 58, accurate and correct?

1772 Objected to as incompetent, immaterial and irrelevant; that the conclusions of the witness as stated in these pages cannot be made facts by his statement that they are accurate and are facts; that what they contain cannot be offered as anything more than the individual opinion of the witness as to matters which are not known and accepted as facts, but are purely theoretical; that the question calls for a conclusion of the witness which is not competent or material, and I want the opportunity to read that before we take up any cross-examination.

A. So far as these pages contain statements of fact they are accurate. I mean to say that I have checked up these pages and that whenever a statement is made there as a statement of fact I have found that each one of those state-
1773 ments is correct. I have done that since the pages were prepared.

(Whereupon counsel for the government asked to have pages 55, 56, 57 and 58 of said report copied into the evidence.)

Same objection; and further that part of article by Cooley is introduced without offering the whole.

COUNSEL FOR GOVERNMENT. We have picked out those por-

tions of the document which we conceive to be material, and if upon examination counsel desires any other portions of it in the record we will be glad to put them in, the object in not putting in the whole document being merely to economize space in the record.

(Whereupon said pages so offered were received in evidence, and are in words and figures following, to-wit:)

"EFFECT OF INHABITATION.

"Inhabitation may produce profound changes in the flow of the streams which drain a local watershed or basin, and, within limits, modify the climatological conditions. The nature and extent of these changes, the effect of inhabitation, as already inferred, is depend-
1774 ent largely upon the superficial feature, the distribution and character of the drift or glacial deposits, and the nature and disposition of the underlying rocks.

In a region of steep slopes and scant covering of impermeable rocks, wooded, the protected surface, the humus and debris, absorbs and retains the falling waters, distributes them more equably. Yet there comes a time when this capacity is exceeded, or when the surface may be frozen or impermeable, and also when a succession of dry seasons leaves no moisture, and the result is that the earliest records may show as great extremes of high and low water as the recent. After the clearing away of the forests, the slopes drain more readily and fully, the supply retained is less and sooner exhausted, and there recurs constantly those extremes of high and low water which were before phenomenal. The flow of water is more immediately dependent upon the meterological conditions. The slopes, too, are more readily erodable, the streams become torrential, and their beds choked with the unusual supply of detritus, which of itself increases the apparent volume and extent of overflow.

If a similar region is underlaid with permeable strata, then the rainfall percolates downward, except when in great excess or, when the surface is frozen—a rare circumstance under such conditions. The streams rece)ve
1775 a more equable supply, and may even continue after successive years of dry weather, from the supplies

stored in the sub-strata. Under these circumstances inhabitation may not materially change the natural order.

In a flat region, or one of gentle slopes, with impermeable, subsoil, the water collects in the depressions or moves slowly over the surface as a thin sheet. If the fall of water is moderate it may never reach the streams, but evaporates; if large, a great volume will accumulate upon the surface, to finally reach the water courses in larger floods than ever come from any other class of watersheds. Unless the ground is frozen, it takes heavy precipitation to start the streams, and in dry weather the flow, of course, ceases, the surface gives up the little mositure it may contain cracks and is capable of receiving considerable water before it again flows away.

If, during the ages, a few feet of the surface have become permeable through the action of frost, drought and vegetation, a soil or mold is formed; the depressions filled with absorptive peat or humus, or remaining as ponds and lakelets, the action is modified. After a drought, it may take even more water to so saturate the surface as to make contributions to streams, the flood volumes will ordinarily be less and the flow more prolonged, and except under extreme conditions the flow
1776 from lakelets, ponds and bogs may not entirely cease. Such areas are not usually timbered. This condition would be further conservative and distributive of flow.

Inhabitation drains the natural reservoirs which have been furnishing a scanty volume to the streams in dry weather. It ditches the lands and increases their porosity so that the surplus water is more readily collected and more rapidly carried away; but this is not all. The land, though more absorptive, does not have to become charged to the full capacity of the spaces between the particles, to overflow, as it were, but the waters percolate to the drains; the action is reservoir like, equalizing. The capacity to take rainfall is also greatly enhanced, and the precipitation must be rapid or frequent to overflow the ground for any length of time and to saturate it beyond a capacity for more in a brief time.

These conditions, with extreme precipitation or frozen ground, may not effect floods. After extreme drought, the flow will start sooner. In the ordinary case, the

flow will come quicker, more gradually and last longer, but the result upon the stream will depend upon how far the reservoir action of the ditched lands will outweigh the destruction in large measure of the natural reservoirs. In any event the low water flow of the ordinary
1777 year is greatly lessened or wholly stopped, as the drained lands will not part with their moisture beyond a certain point, except through vegetation and ordinary evaporation. A diminution in the forest area, exaggerates the extremes, while its increase is conservative.

If we suppose the same general topography with shallow cut valleys, the substrata permeable, then the results will vary materially with the precipitation during the year, or during successive years. The tendency is to distribute results like permeable strata with steeper slopes, or with deeper cut drainage lines. The flow through permeable strata is necessarily slow, but is like flow everywhere, requiring grade to carry the water to some point of delivery. The general surface of this grade is called the ground water plane, and its height and slope vary with the supply of water, or with the season or year. Under the conditions of land stated, it lies necessarily close to the surface, so that heavy precipitation may cause the ground to be entirely filled, or to overflow, with flood conditions resembling those previously described, while the low water flow is well maintained. So from such surfaces, in wet years, heavy floods are to be expected, and again in other years, none at all. Inhabitation will drain such regions so as to
1778 lower or keep down the ground water plane, and to this extent may exaggerate flood conditions and diminish the supply for equitable distribution without impairing the low water volume of the dryer years. Yet lowering the ground water plane leaves the ground above in a reservoir condition, so that the effect under some circumstances may be conservative as to flood exaggeration.

Such permeable grounds are usually more or less timbered. The clearing away exaggerates the surface drainage without any marked effect upon the low water volume of the streams.

The four general conditions discussed are typical. There are endless variations in the conditions of sur-

face, configuration, subsoil, depth to rock and its character and disposition, the distribution of drainage lines, in different basins and even in the same watershed; differences in climatological conditions, in the amount and distribution of rainfall with the season, and with the years,—all factors in the flow from the watershed in wet and dry seasons, in flood and drought. As the flow of streams is studied, the hydrography of basin interpreted, all these things must be more or less appreciated and as the causes are apprehended the habits of the stream are understood.

As we understand the changes brought about by in-
1779 habitation in typical cases, we can apply the inferences to the conditions that may prevail in any given basin, and thus reach results significant of the future. These may have a profound economic and sanitary importance and be well worthy of attention, with a view to correction or such provision as should precede rather than follow when necessity compels.

In general, it may be said, that the tilling of the surface, enables it to take the rainfall more readily, makes it more immediately absorptive than the prairie turf of centuries, often hard and compacted so as to shed the rainfall rapidly. At the same time, when the ground is saturated, the surface flow carries great quantities of material as silts to choek the stream bed or build up bottoms. This action is vastly exaggerated under the condition of frozen ground with melting snow, or the spring rains which settle the frost-heaved ground. So far then as inhabitation may exaggerate the floods, or decrease the low water, and with the vastly increased supply of detritus from the tilled lands in any event, the streams themselves are placed under much more difficult conditions. In part, no doubt, recent popular ideas in regard to the change in the flow in streams are due to this fact.

It may also be stated generally that winter may be-
1780 gin with rains, a melting snow, to freeze quickly and close the surface against absorption, and that this condition will produce spring floods in any region when the accumulated snows are melted, often with drenching rains, leaving even the underlying soil devoid of moisture. Such a condition prevailed over a large por-

tion of the upper Illinois basin in 1887. Heavy ice or snow water freshets, followed by a very dry soil and as little land-water in the Illinois river at Morris (in-May) as known for thirty years. This probably came almost wholly from the natural surface reservoirs.

It is no doubt true that all these effects of inhabitation react upon the meteorological conditions—to what extent is a matter of speculation. It is the general belief, west of the Missouri river, that the rainfall is increasing (there seems to be little or no doubt of it), and this result has been ascribed to the tilling of the ground, the increasing porosity and absorbing power of the surface. Such effects, if occurring in Illinois, would be less noticeable with the greater precipitation in this state. It is difficult to believe that the profound meteorological causes can be materially changed, but the local cycle, subsidiary thereto, can no doubt alter in some degree.

Although the flow of local or tributary streams may be profoundly modified by inhabitation, this is true, in less degree, of the main stream or artery, the change
1781 being less with the area of basin considered.

The flood volume of a stream is never equal to the combined flood volumes of the tributaries, and with many tributaries and a large area, does not even approach such a volume. The several tributaries will not reach high water at the same time, nor will their floods reach the main stream conjointly; neither do they enter at the same point, but are distributed along the valley. The practical result is that the duration of the flood in the main stream is much lengthened, and the volume is correspondingly less than the aggregate of the tributaries. Alteration in the flood conditions of the tributaries will not materially change the time or order in the contribution to the main stream, and as the results are only partially cumulative the effect is relatively less. In many large basins no sensible change would probably occur.

The reverse is true, in a less degree, of the low water volumes. No two tributaries are in exactly the same condition as to low water at exactly the same time, but as the low water period is very much longer than that of floods, the results are more nearly cumulative. It is

found, practically, that the low water volume in small basins is less per square mile than in large ones. Thus, the Mississippi at Grafton carries about four times the
1782 volume per square mile of its watershed as compared to the Illinois, though the conditions are not strictly similar.

Rains may not be uniformly distributed in any one year, nor in the same manner during the succeeding one; a considerable range in latitude may be covered, giving a very moderate and prolonged flood from the melting snow in streams running southerly, and cumulative results in those running northerly; basins may be differently shaped, thus collecting the waters rapidly and cumulatively, or slowly and distributively, a tributary basin may be subject to an extreme local flood, from extreme precipitation, which seldom exceeds the smaller areas at a given time. So from many causes, as the stream grows larger and drains a greater area, the extremes of low water and flood are relatively lessened, and the effect of inhabitation are less marked.

In all the results due to inhabitation, the detritus contributed to the main stream is greatly increased. The effect of this may be profound in a stream bed of little grade, and which, under previous conditions, had not yet adapted itself to its work. This, coupled with the diminished low water volume, has an important bearing upon the navigable utility of the stream in the future.

Under the previous head, the character of the upper Illinois watershed has been set forth—impermeable substrata, with a good depth of permeable surface, flat or
1783 moderate slopes, with considerable bog, marsh and lake, and little timber, the main valley not adjusted to the drainage conditions below Utica. Inhabitation will increase floods, greatly reduce the minimum flow, multiply the amount of detritus. The tendencies will be destructive and most unhealthful in the lower valley. The conditions are presented more specifically, and in detail, later in this section of the report."

Q. Mr. Cooley, I call your attention now to a subdivision of this subject, entitled "The Desplaines Watershed," beginning on page 69 and extending over pages 70, 71, 72, 73, 74 and 75, to the beginning of the subdivision of the subject entitled "The Kankakee Watershed." Have you read over this subdivision of the subject since the last adjournment?

A. I have.

Q. Are the facts which are therein stated to be facts accurate and correct?

1784 Same objection.

A. They are.

(Whereupon counsel for the government asked the reporter to copy pages 69, 70, 71, 72, 73, 74 and 75 into the record.)

COUNSEL FOR DEFENDANT. I further object on the ground that it is sought to introduce a part of an article written by Professor Cooley, and that it is not competent unless the whole is offered; this without waiving the former grounds of objection.

(Whereupon said pages 69, 70, 71, 72, 73, 74 and 75 so offered and received in evidence, are in the words and figures following, to-wit:)

"The Desplaines Watershed.

The Desplaines unites with the Kankakee just east of the west boundary of Grundy county, to form the Illinois. It drains an area of 1392 square miles, almost wholly within the counties of Will, DuPage, Cook and Lake, and in Kenosha county, Wisconsin.

The general direction of the basin is north and south with a length of 90 miles, and a greatest width from east to west of about 25 miles. The watershed contains three characteristic or true basins,—the Desplaines

1785 proper, Salt Creek, and the DuPage River. In a strictly topographical sense, however, the Desplaines basin does not extend farther south than the great boundary ridge of the lake basin, which crosses the old outlet in the vicinity of Willow Springs, or this basin is within the rim of the lake watershed. Normally, therefore, the drainage south of Willow Springs pertains to the outer slope of the main ridge, and to this class belong the considerable areas drained by Hickory and Jackson creeks. The Salt Creek basin normally extends southward nearly to Willow Springs, between the ridges now drained to Flag Creek, but the stream broke through a gap north of Western Springs, and now crosses the slope of the Desplaines basin to Riverside.

Considering the manner in which the surface configuration of this portion of the State has been formed,—

a series of troughs left between morainic ridges by the retreating glacier,—the topography is better understood. The several minor watersheds would then be depressions between the ridges, gradually closing, running out to the northward in a general flat ridge, as the theory indicates. Thus, there is the ridge which limits the Desplaines watershed at Dresden, opposite the mouth of the Kankakee, extending northward and uniting with the main ridge to enclose the DuPage watershed, a second ridge uniting northward and defining the Salt Creek
1786 watershed, and finally, the eastern ridge of the Desplaines watershed, which, however, does not close upon the headwaters of the Desplaines, a summit slough draining northward, as well as southward, to Root river, which empties into Lake Michigan at Racine.

This general series of ridges closing or uniting northward is characteristic, and is illustrated in the divisions of the headwaters of the Chicago river and in the lake ridge now undergoing erosion, from Winnetka northward, uniting with the east ridge of the Desplaines watershed west of Waukegan.

All these ridges terminate to the south, are virtually cut across by the old outlet channel which drained these troughs and the glacial waters, afterwards the three upper lakes from the bay which covered the site of Chicago, down what is now called the Desplaines valley below Summit.

The mother rock underlying the whole of the Desplaines watershed, except its extreme lower end, is the Niagara limestone. The Cincinnati group extends up the Desplaines and DuPage rivers five or six miles from the mouth. The watershed is then underlaid with impermeable rock, except a very limited portion of the southern end which carries some water, the Cincinnati group and possibly the lower strata of the Niagara, if
1787 of the same horizon as the rock underlying the clay beneath Chicago from which considerable supplies are obtained.

These ridges and intermediate deposits overly the rock from 20 to 100 feet in thickness, and, as was to be expected, are in the main unstratified, as they were left by the retreating glacier, though a greater tendency to stratification is exhibited as the streams in the lower levels are approached. As the great main channel is

approached, the tendency to stratification is more pronounced; beach, terrace and gravel deposits occur, the latter behind gaps in the ridges, as at Plaintifield, where the escaping waters left only the heavier material. As a whole, however, the portion of the Desplaines watershed which contains formations which will absorb any considerable proportion of the rainfall and deliver it equally to the streams as ground water, is very limited and confined for the most part to the lower end of the watershed.

The action of the original forces would leave the surface of the slopes in folds or rolls, the tops of the ridges in knobs and depressions, the bottom of the trough, the present stream, nearest to the eastern or innermost ridge. These depressions, these hollows, would drain into each other through the lowest lines, or the sloughs, build up, through vegetable growth and sedimentary deposition, into flat prairies, while the rolls and knobs would leach
1788 out, become more friable, marly, and, together with any superficial deposits of sand or gravel, become the sites of groves and belts of timber. The farther north the ridges closing on each other, becoming broader and flatter, the more characteristic this development, the larger depressions producing great bogs, swamps and lakes. In time, as the sloughs cut down, prairies would become dry.

This whole conception is fully borne out on the Desplaines watershed,—dry prairies, prairies still wet, peaty bogs and swamps, small and shallow lakes becoming so, and lakes so large and deep that wave action maintains their integrity except in sheltered areas, all with more frequent belts and groves of timber northward.

This condition of things in nature makes the surface more absorptive, and to a greater depth, and arrests the waters, delivering them more equably to the streams and maintains from the overflow of lakes and ponds and the leachings of swamps and bogs a better low water volume. The clearing away of the timber, the drainage of the wet prairies, the reclamation of bogs and swamps, removes the water faster, destroys the reservoirs of low water supply.

None of the watershed can be considered hilly or precipitous, although where the old outlet cut through
1789 the ridge, from Willow Springs to below Lemont, it has that appearance. Beyond the top of the bluffs, however,

the usual characteristics of gentle undulations are observed. The lower part of the watershed was originally one-fourth to one-third timber, increasing northward to one-third to one-half the area.

The upper Desplaines valley above the Ogden-Wentworth dam, near Summit, has an area of 634 square miles and a length of 62 miles. This includes the Salt Creek valley which breaks through the dividing ridge near Fullersburg, its area above that point being 110-1/2 miles with a length of 26 miles.

The fall in the flood plane of the Desplaines is 90 feet in 60 miles, or at the rate of 1-1/2 feet per mile above the Lyons dam. The fall in Salt Creek is at the rate of 3 feet per mile for 18 miles above the Fullersburg dam. From the Fullersburg dam to the Lyons dam, in the pool of which Salt Creek empties, the fall is 41.3 feet. about 8 miles by the course of the stream and 5 by direct line. The Lyons dam is 24.2 feet above Chicago datum, or low water of Lake Michigan as adopted by the Canal trustees in 1847.

Both the Desplaines river and Salt Creek, in their courses through Cook county above Summit, are very direct, without any material development in crooks and
1790 bends. They have very little width of flood plane, are virtually deep grooved in the prairie, and extreme high water rises nearly to the prairie level. In Lake county the Desplaines shows more uneveness in grade, with some bottoms in places, more like natural lakes drained out than a flood plane excavated by erosion, At Riverside a rock barrier is crossed with a descent of about 14 feet in three miles. A dam exists at this point, and also at Half Day, in Lake county. There is also a dam at Fullersburg, on Salt Creek.

The lower Desplaines extends from the Ogden-Wentworth dam to the junction with the Kankakee, a distance of 41.6 miles—a total fall of 105 feet at low water and about 6 feet less in flood. The area is 758 miles, of which 172 lie above Dam No. 2, at Joliet, the area draining to the canal below Summit being included.

The drainage of this portion of the valley is in the old outlet, virtually a channel of passage for thirty miles without other tributaries than the bluff drainage. In flood, a portion of the waters flow to Lake Michigan over the present artificial divide, the Ogden-Wentworth dam,

by the Ogden-Wentworth ditch, which was designed to drain the Mud Lake region lying between the Desplaines and Chicago rivers.

In nature, the Mud Lake divide was near Kedzie
1791 avenue, Chicago, five miles east of the Desplaines at the dam. It was overflowed in floods for a wide extent, the surplus waters going to the west and south forks of the South Branch of the Chicago river. Mud Lake itself had considerable depth and was the route followed by the early French explorers and traders, and for these reasons no doubt the Desplaines was surveyed and reserved as a navigable stream to Lyons bridge.

Probably at one time, the entire upper Desplaines, and even as far south as the rock outcrop above Lemont, drained to Lake Michigan, the same as the Calumet basin now does. The south branch of the Chicago river to Bridgeport originally had a capacity proportioned to such a condition or about the same as the Calumet from a similar area, and the bed of Mud Lake for a long distance bears every indication of having been the bed of the Desplaines. The indications in the Desplaines valley below Summit, as previously explained, are all indicative of recent occupancy by the present river.

There are many ways in which the long flat divide at Kedzie avenue could have been built up and we believe there is a tradition that the beaver was concerned in the matter. In any event, the work once initiated, natural silting would carry it on until the waters were turned out the old pass.

At the present time a larger proportion of the flood waters of the Desplaines escape to Lake Michigan than
1792 under former conditions, for, though the dam is supposed to be at the old level of the natural divide, it is close to the Desplaines with a comparatively free channel of escape by the Ogden-Wentworth ditch.

The channel of the lower Desplaines is abnormal, or is determined by the conditions left by the ancient channel. In the 'twelve-mile level,' below Summit, there is practically little grade at any stage of water and the bed is the old remnant, or slough, among the boulders and in rock pockets. Thence to Lake Joliet, no channel has been cut by the present stream farther than to denude one to three feet of superficial deposits overlying the rock. For ten miles above Lake Joliet, the descent is at the rate of

eight feet per mile. Lake Joliet and Lake DuPage are long, deep and wide pools, aggregating over eight miles and without sensible fall, entirely beyond any present forces or requirements. Between them are three miles of slope and one-half mile beyond Lake DuPage, over rock, the Desplaines unites with the Kankakee to form the Illinois.

The dams across the Desplaines are as follows: Daggett's Mill, one-half mile below Lockport; Dam No. 1, ten feet high. belonging to the State, Joliet; Dam No. 2, eight feet high, one-half mile below Dam No. 1, also belonging
1793 to the State, and Adam's dam, six feet high and less than a half mile below No. 2. Formerly a dam existed at the foot of Lake Joliet at Treat's Island, and also one at the foot of Lake DuPage. These have long been abandoned.

The State dams form two pools, aggregating a length of one and one-quarter miles, in which the Illinois and Michigan Canal crosses the Desplaines river.

One mile below Dam No. 2, Hickory creek is tributary from the east, draining an area some 18 miles long and of 130 miles. Jackson creek enters from the east, near the mouth of the DuPage, draining an area 10 to 12 miles long and of 88 miles. Both of these streams belong to the outer slope of the rim ridge of the Lake basin.

From the north, the DuPage enters four miles above the mouth, draining a basin, including Rock Creek 40 miles long and 366 miles in area. This stream descends rapidly from Plainfield, but no detailed information is at hand. The canal crosses in a pool formed by the erection of a dam eleven feet high at Channahon, and formerly a feeder dam for the Joliet level existed above. The flow of the stream is better mentioned in dry seasons than that of the Desplaines at Joliet.

The following tabular exhibit gives the distances, areas of drainage, elevations referred to Chicago datum
1794 and high water in the Desplaines river. The distances are given from the mouth of the stream and the elevations of low waters are + or — according as they are above or below Chicago datum, the low water of 1847 in Lake Michigan. High water is in feet above low water. The areas are given to characteristic points and include that tributary to the canal below Summit; also river frontage over distance between points designated.

Point Designated	Distance from mouth	Watershed Area	Watershed Total	Elevation Low Water	Elevation High Water 1881	Remarks
Bowmanville Cutoff	60.0	440	....	33.0	17.0	Near South Line, Maine.
Riverside Dam	43.6	190	630	24.2	5.8	Salt Creek, 3/4 miles above.
Brewery Bridge	42.6	3	633	11.0	8.3	Navig'ble Stream begins.
Ogden-Wentworth D	41.6	1	634	8.0	7.3	11.7 above Datum.
Willow Springs	35.2	....	....	8.0	7.1	.....
Sag	30.4	....	....	8.0	6.1	.....
Walkers Quarry	28.8	39	673	8.0	....	Rock escarpment.
Romeo	23.0	....	....	0.0	....	Level of Lake.
Lockport	19.2	156	790	—22.0	4.8	Norton's Tail Race

1795

Point Designated	Distance from mouth	Watershed Area	Watershed Total	Elevation Low Water	Elevation High Water 1881	Remarks
Dam No. 1	....	....	....	—42.3	3.75)	High water dams.
Dam No. 2	14.6	16	806	—52.5	4.9)	Low water actual.
Adam's Dam	....	4	810	—60.5	6.0)	
Hickory Creek	13.6	130	940	—67.5	....)	Low water, 1883,
Head Lake Joliet	12.0	....	....	—77.0	5.0)	taken below Joliet
Foot Lake Joliet	6.5	....	....	—77.3	4.3)	high water estimated from best information.
Jackson Creek	4.8	86	1026	—87.0	....)	Below Lake Joliet
DuPage River	4.0	366	....	—88.8	11.8)	is backwater from
Head Lake DuPage	3.6	....	....	—90.0	....)	Kankakee in high
Foot Lake DuPage	0.6	....	....	—90.3	....)	water.
Illinois River	0.0	....	1392	—93.7	15.7)	Junction Kankakee.

The first area in the table includes the proposed diversion of the floodwaters of the Desplaines as contemplated by bill passed by the General Assembly in 1887. The route was along the south boundary of the town of Maine, down the valley of the North Branch and to the lake from Bowmanville, across Lake View north of Ravenswood. An additional area of 60 miles of the Salt Creek basin was also included in the estimates, or a total area of 500 square miles out of 634 above Summit This project contemplated continuing the ordinary dry weather flow southward.

1796 The Ogden-Wentworth dam at the Desplaines is a little more than four miles from the present city limits of Chicago and some six miles from deep water in the branches of the Chicago river. It is ten miles direct to Lake Michigan at the nearest point.

There is no considerable area of true bottoms along

the Desplaines below Summit. Down to Lake Joliet, the stream has not cut a natural bed, or the banks are of little height, and the stream overflows widely for a half mile or more except on the steep slopes in the vicinity of Lockport. The State works conduct the waters through the city of Joliet. Aside from a limited area where Hickory Creek debouches there are no bottoms subject to overflow until the foot of Lake Joliet is reached, except a marshy fringe bordering the high ground on either side. In the seven miles below the lake to the Kankakee, true flood plane bottoms occur, mostly on Treat's Island and about the mouth of the DuPage. These, like all bottoms built up by overflow, are at mean extreme water and are overflowed in an occasional year. These bottoms are all within the range of backwater from the Kankakee and are only overflowed in case of floods from that stream. The area from Lake Joliet to the Grundy county line is ..... acres, of which Treat's Island contains ..... acres and the DuPage bottoms ..... acres.

The flood discharges in the Desplaines have been taken at Riverside and at Joliet, in some cases by actual ob-
1797 servations, but generally from the high water marks giving the depth flowing over the dams. Such results, if carefully deduced, are reliable within a small percentage. The volumes are given in cubic feet per second, the usual unit of engineering measurement.

The flood which culminated at Riverside, on April 21st, 1881, is the most notable of recent years. Its volume was 13,500 cubic feet per second. Floods of nearly equal magnitude have occurred in other years, for which the notes are not at hand.

The highest flood since 1881 culminated on February 9th, 1887, with a volume of 10,324 cubic feet. It fell to 8,000 feet on the 10th, to 7,000 feet on the 11th and by the 16th had dropped to 2,000 feet, rising again on the 19th to 5,174 feet.

Every five or six years for 50 years, there has occurred a flood upwards of 10,000 cubic feet in volume. The memoranda are not in hand at this writing.

The ordinary yearly flood as deduced from marks at the Lyons dam, is 6,000 to 7,000 cubic feet per second.

From the Fullersburg dam, on Salt Creek, the four highest floods in thirty years give results, as follows:

1876—2,860 cubic feet per second.
1881—2,760 cubic feet per second.
1886—2,612 cubic feet per second.
1798 1887—Feb. 10—2,860 cubic feet per second.

The mean may be taken at 2,800 cubic feet. It will be noticed that if the volumes of floods were in proportion to areas of basins, the flood at Riverside corresponding to the above should be 16,000 cubic feet. This is not true, however, for reasons previously given. The rule applied in basins of similar characteristics would give 9,000 feet. This ratio may apply for rain water floods, but in case of melting snow, with difference in latitude, as in all the larger floods, the problem does not yield to analysis.

The floods in Joliet are estimated from the height on the three dams, and the results check each other closely. The following notable floods have occurred:

1887, April 7—6,410 feet per second.
1881, April 21—6,550 feet per second.
1883, Feb. 16—6,370 feet per second.
1887, Feb. 11—5,775 feet per second.

The highest mark in 21 years at Dam No. 1 gives 6,550 cubic feet. The mark pointed out by Mr. Adam above Dam. No. 2, to which the water has reached three times in 30 years, gives 5,860. The normal extreme flood may be taken at 6,300 cubic feet per second, occurring probably four times in thirty years.

1799 The flood of 1887, which reached its height on February 11, with a volume of 5,775 feet, fell to 1,460 feet on February 16, and rose to 5,385 feet on the 19th. If these volumes be compared with those for Riverside, some idea may be formed of the volume escaping to Lake Michigan through the Mud Lake region.

The volume flowing through the Ogden-Wentworth ditch as measured at Kedzie avenue in February, 1887, was on the 10th, 7,800 cubic feet; 11th, 4,636 feet; 14th, 1,625 feet; 18th, 4,000 feet; 19th, 3,042 feet.

An ice gorge on the Desplaines on the 9th and 10th of February, affected the amount of water turned toward the lake, but it is apparent that in large floods not less than half the volume of the Desplaines passing Riverside goes to Lake Michigan. All the information obtainable also indicates that it was not materially different before the ditch was cut. The railway embankments across the Mud Lake valley have been compensated for

by the gradual enlargement of the ditch, an operation which will continue in the future with an increasing discharge toward Chicago.

The present dam is 11.7 feet above Chicago datum, or 3.7 feet above low water, and 3.5 feet below high water of 1881. When the water in the Desplaines stands at the crest of the dam, the flow down the Desplaines is 800 to 1,000 feet per second, depending upon whether the water
1800 is falling or rising, or on the condition of vegetation in the 'twelve-mile level.' Above this volume, the proportion escaping to Chicago increases rapidly with the height of flood, and for this reason the floods passing Joliet are more uniform in volume, one year with another, than at Riverside.

No data are in hand in regard to the flood volume from the DuPage. With this it would be possible to estimate closely the normal extreme flood from the Desplaines into the Illinois river. This probably does not much exceed 12,000 cubic feet per second.

It may be assumed thus that the normal extreme flood is, at Riverside, 12,000 feet; at Joliet, 6,300 feet; and at mouth of river 12,000 feet. Any flood above two-thirds these volumes would be a notable one; and probably average floods, one year with another, do not exceed this.

If the Chicago outlet were closed so as to turn all the water southward, the volume at the mouth of the river would be about 20,000 feet, upon the basis of 12,000 feet for Riverside; and at Joliet, the volume at Riverside would be increased by one-sixth.

The shape of the Desplaines basin, (long and narrow), and the fact that it covers a considerable range in latitude, materially decreases the volume while increasing the duration. After heavy precipitation, the maximum
1801 flow will come from the immediate body of the watershed, while the flow from headwater will come in to sustain the volume and prolong the flood. In 1887 the river was falling at Riverside before the flood had culminated in Lake county. The melting snow on the northern portion of the basin will maintain the flow for several days after it has melted and run away from the southern portion. In 1881 the flood maintained its height nearly for four days, and lasted about 21 days. The ground was practically saturated when winter set it, and about one foot of water in the shape of ice and snow accumulated,

and all ran out or melted during three weeks, at a temperature a little above freezing point and without material rain. The southern portion of the watershed was entirely bare before the northern snows began to melt. For this reason the flood volume held measurably constant, even toward the sources of the stream, until the snow at headwaters began to be exhausted. The conditions presented in this flood are of extraordinary occurrence only. On August 10th, 1867, a downpour of remarkable intensity and purely local to the waterhead immediately north and east of Joliet, produced for a few hours an unprecedented flood, carrying away the guard bank of the upper pool and inundating a portion of the city.

1802 These extraordinary occurrences do not, however, extend over wide areas, and for this reason their effects are local rather than general. If they did, the results would be vastly beyond experience upon large streams. Still, to the extent that extraordinary occurrences may be in a measure simultaneous in a long period of time, is due those great effects that may occur in a generation or a century. In these matters, the law of probabilities comes in with its grand and certain averages as much as in apparent accidents and insurance.

The dry-weather flow, or low-water volume, is very small, as has already been inferred from the physical characteristics of the watershed. In 1887, Salt Creek was entirely dry at Fullersburg. The Desplaines, at Riverside, reached a minimum of 4.27 feet per second (256 feet per minute), and for five months did not exceed 1,000 feet per minute. The stream has been known to be lower than this, but has never wholly run dry.

In 1879, a discharge taken by Mr. Matthewson at Romeo, four miles above Lockport, gave a volume of 5.65 cubic feet per second (339 feet per minute). The minimum volume at Riverside would not be increased, in fact, might be diminished, in passing through 'the twelve-mile level,' by evaporation and vegetation, in the run to Joliet. Three hundred feet per minute may be assumed

1803 as the mean extreme low water at Riverside and at Joliet, with a volume below 1,000 feet for several months of nearly every year.

For several years, owing to leakage, in and about the Ogden-Wentworth dam, no low-water flow has gone below Summit for some months of nearly every year. This

was the case in 1887, and also, we believe, in 1888. The ice interests below Summit, have always remedied the matter in time for the winter's ice crop.

No estimates have been made of the low water below Joliet, nor of the DuPage at Channahon. The DuPage is known to sustain its flow much better then the upper Desplaines, due probably to considerable area of permeable gravel beds, and to springs from the underlying rock in the lower part of its course. The Desplaines, below Joliet, is also under similar conditions. It is presumed, however, that the low-water volume of the Desplaines, at its junction with the Kankakee, will not be increased to over 17 to 20 feet per second (1,000 to 1,200 feet per minute) for its mean extreme low-water, and that it will run under 50 feet (3,000 feet per minute) for some months of nearly every year. The minimum of twenty years will probably be less than that given.

The effect of inhabitation has already been forecast. The draining out of the wet prairies, bogs and marshes, the clearing away of surplus timber, will make the floods
1804 come quicker and of greater height, and their duration will be shortened. The flow of the stream will be less sustained or the low water period much prolonged. In prolonged dry seasons, or in a succession of such seasons, the only sources of supply will be the lakes, as the bogs and marshes will dry out and the permeable beds to feed springs are of limited extent and readily exhausted. The minimum flow at Riverside and at Joliet will probably reduce to one-half or two-thirds its present volume.

The flood volume reaching Joliet will probably not increase, owing to the peculiar situation at Summit, by which an increasing proportion is likely to flow to the lake in the future, if the present conditions and tendencies remain unchanged. The flood conditions at Joliet would be the same as those above, provided the waters were prevented from reaching Lake Michigan, but this would increase flood heights at Summit by four or five feet. If the lands along 'the twelve mile level' were drained by cutting the rock escarpment at Lemont, a matter of no serious cost, the same results as to floods would obtain in Joliet.

The amount of surface washing or silt from the tilled ground will also increase, but these will not be largely

carried southward beyond 'the twelve-mile level' under present conditions, but will go for the most part into
1805 the Chicago river. Should, however, the changes be made as stated above, they would build up the Desplaines bottoms below Summit and ultimately fill up Lake Joliet, until the prism is reduced to the requirements of an alluvial stream, a velocity in flood approaching two miles per hour in place of less than one-half mile as at present.

The remarks in regard to flood increase will also apply to the basin below Joliet. Owing to the conditions under which floods come from above, there will be no radical increase. The low water volume in this portion of the stream will be better sustained, as the permeable beds are of greater extent upon the lower watershed. The rock water will not alter materially in volume. The area of pond or lake is, however, very limited. The silting from the increased supply of detritus will reduce Lake DuPage, as already intimated, in regard to Lake Joliet.

As a whole, the floods will probably be somewhat increased at the mouth of the river, but to no considerable degree, unless the entire Desplaines is turned southward. The silts carried away will ultimately increase considerably. The minimum volume will probably not reduce beyond one-half or two-thirds the present amount. Had we records of the primitive conditions, it is likely that material changes would now be evident.

1806 These changes are likely to reach their limit in fifty years. After that, the area in trees is likely to increase rather than diminish, the effects of drainage will have been fully developed, the ponds and lakes will not be farther reduced,—may be increased,—and the general permeability of the surface will increase with the fuller development of the country. The water supply to towns and villages from sources not now contributing will ultimately reach the streams.

All these conclusions are based on the supposition that no radical change be made in the old outlet such as restoring thereto a part of the outflow of the great lakes, and also without regard to the present contributions from the Illinois and Michigan canal.

The hydrography of the Desplaines basin has been discussed at length on account of its very important relations to any plans for the increase of flow from Lake

Michigan at Chicago, and also to the economic and sanitary problems of that city and its environs."

1807 Q. I call your attention, Mr. Cooley, particularly to page 72 of this volume, being one of the pages already offered in evidence, where we have an elevation on Dam No. 1 of the flood of 1881 of 3.75 feet; an elevation on Dam No. 2 of 4.9 feet; and an elevation on Adams Dam of 6 feet. Were those elevations correctly ascertained prior to the publication of this report?

Objected to, as incompetent, immaterial and irrelevant; that the conclusions of the witness as stated on this page can not be made facts by the statement that they are accurate and facts, call for a conclusion which is incompetent and immaterial.

A. They are.

Those were the elevations that were used in estimating the flood volume through Joliet for the flood of 1881. I have the actual measurements for the flood of 1892 at those dams in Joliet. The height of the flood of 1892 on Dam No. 1 was 3.86 feet; on Dam No. 2, 5.59 feet and on Adams Dam, 6.3 feet.

Re-cross Examination.

1808 COUNSEL FOR DEFENDANT. Q. Let me ask a question of Mr. Cooley right there: where did you get those figures?

A. They are given in part if not wholly in the report of 1905. They are also checked by profiles made by the Sanitary District.

COUNSEL FOR DEFENDANT. Move to strike out the answer as hearsay and not made from personal knowledge of the witness, and as being based upon what are alleged to be original sources which are not produced.

Re-direct Examination Continued.

The report of 1905 is here but I do not think I could refer without looking it up to the sources of this matter, which would take me a little time. All I have here is a memorandum of results. These memoranda were made I think in December, 1910.

Mr. WILKERSON. It may be like other original data of that kind, when submitted to counsel for the other side and they

have an opportunity to check it over, they will not insist on cumbering the record with it.

Mr. SCOTT. That is quite possible.

On cross-examination I was asked the following ques-
1809 tion: "Will you compute for us and at another session give us the discharges in cubic feet per second at an elevation of 13.4, 14.4, 15.4 and 16.4 on the Riverside Gauge?" at page 1667 of the record. I am able to state that now. I have looked it up. Those computations are: At an elevation of 13.4, 822 second feet; at elevation of 14.4, 1402 second feet; at elevation of 15.4, 1982 second meet; and at elevation of 16.4, 2648 second feet.

COUNSEL FOR GOVERNMENT. At page 1674 of the cross-examination, Mr. Cooley, you were asked whether you had not said in the pamphlet entitled "Internal Improvement Commission 1906," that the Desplaines river was a mere surface stream and went dry in summer. I now call upon counsel for the defendant to point out in that book where that expression occurs, especially the latter part of it, "a mere surface stream and went dry in summer." I refer to the expression "and went dry in summer."

COUNSEL FOR DEFENDANT. In answer to the inquiry of counsel I would say that what I referred to on page 1674 of the record appears at page 25 of the "Lakes and Gulf Waterway, Message by Governor Deneen, Report by Internal Improvement Commission of Illinois," published in 1907.

COUNSEL FOR GOVERNMENT. Q. In the passage pointed
1810 out by counsel on page 25, you did not there state that it was a mere surface stream, Mr. Cooley, but on page 5 of this pamphlet you state that it was a mere surface stream over the rock bed. I call your attention to the following paragraph on page 5:

> "From the end of the 'twelve mile level' to Lake Joliet was seventeen miles—a mere surface stream over the rock bed—with a steep declivity over the lower half of the distance descending to a level 76.5 feet below Lake Michigan. Eight out of thirteen miles between the head of Lake Joliet and the head of the Desplaines river at the junction with the Kankakee, is occupied by two deep pools, Lake Joliet and Lake DuPage, with intermediate declivities of seventeen feet. The flow from the Kankakee river itself was originally well maintained from the great marsh expanses at head waters."

Is that the only paragraph in which you refer, so far as

you remember, to the description of the Desplaines river as being a surface stream?

COUNSEL FOR DEFENDANT. I first wish to state, because of the form of the question, that I did not refer to page 5 in answer to the question asked by Mr. Cressy, to point out where, in Mr. Cooley's writings, the matter I referred to in my question appeared, because he asked me with special reference to the statement that it went dry in summer.

I object to this question as calling for the conclusion
1811 of the witness and further because it is leading to an answer which would be directly inconsistent with his statement on page 1674 of the record where he said: "The mere surface stream phrase I have frequently used in describing that portion of the river from Lemont down to Joliet."

(Whereupon counsel for the government offered in evidence the said paragraph from page 5, already quoted.)

(Whereupon counsel for the government asked counsel for the defendant if he had any other place in mind except the paragraph referred to, where Mr. Cooley used the language about this river being a surface stream, and counsel for the defendant replied that he thought there was some other place but he could not answer that question at this moment.)

A. I could not call attention to any such passage.

(Whereupon it was understood that the record might be closed with the understanding that what Mr. Cooley
1812 says is in this paragraph, which can be copied into the record and stand for what it is worth.)

As to whether I have anything further to say with reference to having used the phrase referred to, I would say I think I have used that phrase on other occasions in other reports, but I am not absolutely sure without looking it up. When I used that expression I referred to the portion of the Desplaines river herein mentioned, between Lemont at the end of the twelve mile level, and Lake Joliet, and have explained that in other connections as an evidence of the comparatively recent time at which the Desplaines river in a geological sense has flowed in that direction. The stream is not a deep stream as compared to other portions of the stream, but still has a bed in which the ordinary flow of water is contained. I
1813 mean the stream in that portion where I used that phrase, if I used it, it has been in connection with the

significance with which I have used it in this paragraph that has been read into the record.

Objected to on the ground that it calls for the intent of the witness and is inconsistent with the express statement of the witness that the Desplaines river above Joliet was a mere surface stream; incompetent.

As to whether I have anything further to say with reference to the express statement referred to by counsel, I would say the expression is relative in comparison with the Desplaines river elsewhere which has a deep well-defined bed, whereas the bed over the rock in this portion which I have mentioned or called attention to is comparatively shallow and contains the ordinary flow of the river, but any large flow gets over the adjacent banks.

Q. On cross-examination you were asked in refer-
1814 ence to a statement made by you in a prior writing, that the Illinois river was raised one and two-thirds feet at La Salle by the operation of the pumping works at Bridgeport with a capacity of 60,000 cubic feet per minute. Is there anything you wish to say in explanation of that writing?

Objected to as incompetent.

A. At the time I wrote that pamphlet I was in the employ of the State Board of Health, who were endeavoring to enforce the spirit of the Munn Resolution in regard to the maintenance of a flow of 60,000 feet for the sanitary relief of Chicago. We had tested the pumps at Bridgeport
1815 late in 1886 and had operated them to that capacity, and did operate them for some time afterwards, and I assumed that that was to be continued, but later there came protests from interests along the canal and the canal authorities took the position that the canal was not able to carry the 60,000 feet and the pumps were not found competent to maintain 60,000 feet, and they never were subsequently operated to 60,000 feet, the maximum record for three months being, I think, about 50,000 feet, but generally at a much lower rate.

Counsel for Defendant. Move to strike out the evidence of the witness as to the protests and as to what the record stated as not being competent evidence, being hearsay, and a matter to be determined from the records themselves.

I will explain further in regard to that matter that at that time also I was in the employ of the City of Chicago as consulting engineer to the Mayor and the committee appointed to draft the drainage law, and did engage in investigations for the purpose of raising the flow in the canal to 80,000

feet, and also to determine the feasibility of pumping an additional supply of water over into the Desplaines river by way of the Ogden ditch pending the permanent relief to be secured by the drainage canal, and the reference in this pamphlet, "The Lakes and Gulf Waterway," that has been quoted in respect to the volume of water which would raise the river at La Salle by two feet, refers to that 80,000
1816 feet and above. I will say in that connection that these facts were familiar to me at that time in my employment by the State Board of Health and by the City of Chicago.

Referring to the statement on page 1695, the facts which I have now stated were based on the same kind of information as were the facts in the report to which my attention was called. That figure, 1-2/3 feet at La Salle was based on the result given by Mr. Abert in the report of General Wilson in the spring of 1867, the first report in which he states that a certain volume of water will maintain a certain level in the Illinois river. Referring to remark in fine print in the middle of page 33 of that pamphlet in regard to the low water at Morris, Illinois, in which it is stated: "At Morris the water was as low as known for fifty years notwithstanding the flow in the canal was raised to 60,000 feet per minute or considerably in excess of former years," that remark signifies, with reference to the natural condition of the Desplaines, that the natural low water coming to Morris on the Desplaines and Kankakee rivers for 50 years had not been less than it was in 1887 including the canal water.

1817 Q. Having in mind, Mr. Cooley, that the Illinois and Michigan Canal was constructed and completed in the year 1848, and that this low water of 1887 is said to be the lowest water for fifty years, what would this low water show as compared with the low water in the Desplaines river in a state of nature, that is prior to 1848?

Objected to, as incompetent, immaterial and irrelevant, and because it involves elements other than the flow of the Desplaines river.

A. I would say that remark indicates that the natural low water at Morris in 1887 plus the canal contribution was as low as natural low water, small in volume, passing that point prior to the construction of the canal.

Q. Referring, Mr. Cooley, to the Wilson profile which I believe you testified was compiled from the Preston pro-
1818 file of 1857 or 1858, is there anything that you wish to say further in addition to what you have already said

on cross-examination as to why the low water line on the Wilson profile does not represent the conditions in the Desplaines river in a state of nature?

Objected to, as leading and because the witness has not testified that the Wilson profile does not represent low water in a state of nature.

COUNSEL FOR GOVERNMENT. I call your attention to record page 1717 in which you were asked the following question "Is it not true then that the profile of 1857 more nearly approaches a state of nature than the profile of 1883?"

"A. I think the profile of 1857 differs from the state of nature for more than the profile of 1883." You may now proceed with the answer to the question which I have previously asked you.

COUNSEL FOR DEFENDANT. The objection stands.

A. The profile of 1857 or 1858 represents a condition of the river in which the waters of the Desplaines had been depleted by the canal, but is not a profile of a natural low water. Furthermore, it has no particular signification in determining the navigable conditions in the Desplaines river. It is a limit, representing an extreme condition in any case, and not a usual condition, and it did not occur that that was a 1819 proper or fair expression of a formal condition in the Desplaines river, but only one that occurred at a very remote intervals.

At the time of the Preston profile of 1857 the drainage that was tributary to the Desplaines river at the point in question where the proposed dam of the defendant is situated, was the unmodified drainage of the Desplaines river below Dam No. 1 at Joliet and that below the Channahon Dam on the Du Page river at Channahon, leaving an area of about 250 square miles, the water at low water being diverted for the purpose of feeding the Illinois and Michigan Canal above these two dams. I have testified that the original drainage area in a state of nature which would pass by the proposed dam of the defendant, would represent a drainage from 1428 square miles. All of these 1428 square miles with the exception of 250 square miles had been drained in 1857 to the uses of the Illinois and Michigan canal.

Q. Mr. Cooley, when the Wilson Report of 1868 referred to the Desplaines river as a mere brook with a flow of 1000 feet per minute, to what condition of the river does it refer

as relative to the conditions of the Desplaines river in 1820 a state of nature?

Objected to, the document speaks for itself.

A. It refers to the condition then existing which was after the depletion of the lower Desplaines river below these dams that I have mentioned. General Wilson refers to a condition in which the flow of the river is reduced to about 1000 feet per minute, or between 16 or 17 feet per second. I have taken the low water flow at Riverside in a state of nature at 27 feet per second and the corresponding flow for the area which I have mentioned of 250 square miles would be between ten and eleven feet per second, which together with some seepage from the canal would account for the volume mentioned by General Wilson. This volume mentioned by General Wilson would be utterly inadequate to produce any water power at Joliet in connection with the dams that are alleged to have existed at that point; in fact, most of it is from the watershed below Joliet.

The flow of 1000 cubic feet per minute mentioned above would show in reference to the use of water by the mills at Joliet that at such times as General Wilson referred to there was no water available for the use of the mills at Joliet below the canal level.

1821 COUNSEL FOR DEFENDANT. I have looked over the copy of the gauge readings from the Sanitary District now shown me. I have not made a critical examination of them.

Whereupon counsel for government offered in evidence as supplemental to the gauge readings at Riverside recorded in House Report 263, the gauge readings of the Sanitary District at Riverside from 1905 to 1910 inclusive. The document so offered in evidence was marked "Cooleys' Exhibit 5." And is in the words and figures following:

1821A I, George M. Wisner, Chief Engineer of the Sanitary District of Chicago, do hereby certify that the attached six (6) sheets are a true, complete and accurate compilation, prepared from the records kept by The Sanitary District of Chicago and under the control and in the custody of the undersigned, insofar as the same relate to the gauge readings at the riverside gauge in the Desplaines river maintained by The Sanitary District of Chicago, for the years 1905, 1906, 1907, 1908, 1909, and 1910, and that the figures appearing upon the said sheets indicate the height of the water in said

Desplaines river at 8:00 A. M. of each day as indicated, such depth being shown by the elevation of the surface of the water at such gauge below Chicago City datum, in feet and one-tenth feet.

In witness whereof the undersigned has hereunto subscribed his name this 23rd day of February, A. D. 1911.

(Sgd.) GEORGE M. WISNER,
Chief Engineer of the Sanitary District of Chicago.

1821B SANITARY DISTRICT OF CHICAGO. 1905, 8:00 A. M. READING AT RIVERSIDE GAUGE.

Date	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.5½	Below Gauge	14.3	12.9	13.4	12.1	11.6	12.6½	11.9	11.5	11.9½	12.4
2	11.5	" "	14.6	12.7	13.0	12.0	11.5½	12.3½	*13.2½	11.5	11.9	12.0
3	11.5	" "	14.5	12.5	12.8	11.9½	11.5½	12.1	15.6	11.5	11.8	12.5½
4	11.5½	" "	14.4	12.4	12.7½	12.0	11.5½	12.0	15.7	11.4½	11.8	12.5
5	11.5½	" "	13.7	12.3½	12.5	12.5	11.5½	11.9	14.9	11.4½	11.8	12.1
6	11.5½	" "	13.2	12.2½	12.3	12.5	11.6	11.9	14.1	11.4	11.8	12.1
7	11.5	" "	13.0	12.1½	12.2	12.2½	11.7	11.9	13.5	11.4	12.1	12.2
8	11.5	" "	12.9½	12.1	12.1	12.1	11.6½	12.-	13.1	11.4	12.2	12.2
9	11.5	" "	12.4	12.1	12.0½	12.0	11.6	11.8	12.8	11.4	12.1½	12.2
10	11.5	" "	12.4	12.1	12.0½	11.9	11.7	11.7	12.6	11.4	12.1	12.7
11	11.5	" "	12.5	12.1	13.2	12.2½	11.7½	11.6	12.5	11.5	12.1	12.4
12	11.4	" "	12.5	12.3	18.7	12.7½	11.8½	11.6	12.4	11.6	12.0½	12.4
13	11.4	" "	12.3	12.2	19.5	12.7	12.4	11.5	12.3	11.5½	12.0½	12.3
14	11.3	" "	12.1	12.1	18.5½	12.5	12.1½	11.6	12.3½	11.5	12.0	12.0
15	11.3	" "	12.7	12.-	18.0½	12.3½	12.0	11.6	12.2	11.4½	11.9½	11.9
16	11.3	" "	12.4	11.9½	17.4	12.2	11.8	11.6	12.1	11.4	11.9	11.8
17	Below Gauge	" "	12.6½	11.9	16.4	12.1	11.7	11.6	12.1	11.4½	11.9	11.7
18	" "	" "	13.2	11.8½	15.7	12.4	11.7	11.6	12.3½	11.5½	11.9	11.7
19	" "	" "	13.9	11.8	15.1	12.7	11.6½	11.6	12.2	12.5	11.8½	11.7
20	11.2	" "	14.8	11.8	14.4½	12.7	11.6	11.6½	12.0	13.0	11.8	11.7
21	11.3	" "	14.7	13.0	14.0	12.5	11.5½	12.8	11.9½	12.8½	11.8	11.7
22	11.2	" "	14.3	14.1	13.5	12.3	11.5	12.7½	11.8	12.7	11.8	11.7
23	11.2	" "	14.1	14.0	13.1½	12.0½	11.4½	12.3½	11.8	12.5	11.8	12.5
24	11.1	" "	14.4	13.3	12.8½	11.9	11.4½	12.1	11.7½	12.4	11.8	12.3
25	11.1	" "	14.5	12.9	12.6	11.8	11.4	12.0	11.6½	12.3	11.8½	12.1
26	Below Gauge	12.6	14.2	12.7½	12.4½	11.7½	11.4	12.5	11.6	12.3	11.8½	11.8
27	" "	12.7	14.0	13.1	12.4	11.9	11.4	12.6	11.6	12.2	11.9	11.8
28	" "	14.0	13.9	13.2	12.3	11.8	11.4	12.3½	11.5½	12.2	11.9	11.8
29	" "		13.6	13.0½	12.2	11.7	12.6	12.3	11.5½	12.1½	12.4	11.8
30	" "		13.3½	13.7	12.1	11.6	13.9	12.1	11.5½	12.1	12.7	12.6
31	" "		13.1½		12.2		13.2½	12.0		12.0		12.2

*14.5 at 6 P. M.

OK

T. B.

1821C SANITARY DISTRICT OF CHICAGO. 1906 8:00 A. M. READING, RIVERSIDE GAUGE.

Date	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	12.1½	14.0	14.9	13.50	12.2	Below Gauge	00	00	00	12.0	11.9	13.4
2	12.0	15.9	14.5	13.3	12.3	"	00	00	00	12.2	12.0	13.4
3	11.9	14.5	15.9	13.15	12.5	00	00	00	00	12.0	11.8	13.1
4	12.8	14.5	16.8½	13.0	12.5	00	00	00	00	11.7	11.8	12.8
5	13.4	14.0	15.9	13.1	12.6	00	00	00	00	11.5	11.8	12.9
6	13.6	13.6	15.0	13.4	12.5	00	00	00	00	11.5	11.7	13.5
7	13.0	13.2	14.8	13.4	12.4	00	00	00	00	11.5	11.6	13.9
8	13.2	13.0	14.5	13.3	12.2	00	00	00	00	11.5	11.6	13.5
9	12.8	12.8	14.3	14.1	12.1	00	00	00	00	11.5	11.5	13.2
10	13.2	12.6	14.1	15.3	12.1	00	00	00	00	11.5	11.5	13.1
11	12.6	12.4	13.6	15.4	12.0	00	00	00	00	11.5	11.4	13.1
12	12.3	12.2	13.2	14.8	12.0	00	00	00	00	11.5	11.4	13.1
13	12.1	12.2	12.8	14.5	12.0	00	00	00	00	11.5	11.4	13.1
14	11.9	12.8	12.6	14.3	11.9½	00	00	00	00	11.4	11.4	13.1
15	11.9	14.5	12.5	14.2	11.9	00	00	00	00	11.4	11.4	13.1
16	11.8	13.5	12.5	14.1	11.8	00	00	00	00	11.4	11.4	13.0
17	11.9	13.2	12.5	14.0	11.8	00	00	00	00	11.4	11.4	12.9
18	12.0	12.7	12.5	13.4	11.8	00	00	00	00	11.4	11.4	12.8
19	13.4	12.3	12.4	13.2	11.7	00	00	00	00	11.4	11.4	12.7
20	12.4	12.4	13.1	13.0	11.6	00	00	00	00	11.4	11.4	12.5
21	12.7	15.0	13.0	12.8	11.6	00	00	00	00	11.4	11.4	12.4
22	16.5	16.5	12.5	12.5	11.5	00	00	00	00	11.4	12.0	12.1
23	16.1	16.8	12.3	12.5	11.4	00	00	00	00	11.4	13.6	12.0
24	15.1	16.7	12.1	12.4	11.4	00	00	00	00	11.4	14.0	12.0
25	14.6	18.0	12.0	12.3	11.4	00	00	00	00	11.4	13.7	12.0
26	14.4	18.3	12.0	12.0	Below Gauge	00	00	00	00	11.4	13.7	11.9
27	14.3	17.1	14.3	12.1	"	00	00	00	00	11.4	13.6	11.6
28	13.9	15.8	15.5	12.0	"	00	00	00	00	11.4	13.5	11.5
29	14.1		14.8	12.0	"	00	00	00	11.4	11.4	13.5	11.5
30	14.3		14.1	12.1	"	00	00	00	11.7	11.7	13.5	11.5
31	14.5		13.7½		"		00	00		11.8		12.1

OK

T. B.

1821D SANITARY DISTRICT OF CHICAGO 1907 8:00 A. M. READING GAUGE RECORD AT RIVERSIDE, ILL.

Date	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	13.6	17.6	17.2	15.5	13.3	14.6	11.9	11.6	11.8	14.5	11.7	11.7
2	13.4	17.3	13.5	15.0	13.5	14.1	11.9	11.5	11.7	13.8	11.7	11.7
3	13.6	17.3	14.2	14.4	13.2	13.7	11.9	11.5	11.5	13.7	11.7	11.6
4	13.6	16.8	14.0	13.8	12.9	13.5	11.9	11.4	11.4	14.0	11.7	11.6
5	13.4	16.7	13.6	13.6	12.8	13.9	11.9	11.4	11.4	13.9	11.7	11.5
6	13.3	16.4	13.4	13.3	12.7	14.3	12.0	11.4	11.4	13.5	11.7	11.5
7	13.6	16.3	13.2	12.1	12.6	14.3	12.1	11.4	11.4	13.4	11.7	11.5
8	13.8	16.3	13.0	13.0	12.5	14.7	12.0	11.4	11.4	13.3	11.6	11.5
9	14.0	15.9	12.9	13.5	12.5	15.8	11.9	11.4	11.4	13.1	11.6	11.5
10	14.4	15.4	12.8	13.4	12.4	16.0	12.05	11.4	11.4	12.8	11.6	11.5
11	15.0	15.0	12.9	13.2	12.2	15.5	12.2	11.4	11.4	12.3	11.6	11.5
12	15.0	14.6	13.2	13.1	12.1	14.8	13.8	11.4	11.4	12.2	11.6	11.5
13	14.6	14.5	13.4	13.0	12.0	14.4	13.8	11.4	11.4	12.2	11.6	11.5
14	13.4	14.2	13.3	12.9	11.9	14.0	13.1	11.4	11.4	12.1	11.6	11.5
15	13.4	14.0	13.4	12.8	11.9	13.55	12.6	11.5	11.4	12.0	11.6	11.5
16	13.5	13.9	13.4	12.8	13.1	13.2	12.4	11.7	11.4	12.0	11.6	11.5
17	13.7	14.0	13.5	12.7	12.9	12.9	12.3	11.8	11.4	12.0	11.6	11.5
18	14.2	15.7	13.5	12.6	12.7	12.7	12.1	11.7	12.0	11.9	11.6	11.5
19	15.0	15.0	13.4	12.4	12.7	12.5	12.1	11.7	13.2	11.9	11.6	11.5
20	19.2	14.9	13.5	12.35	12.5	12.3	11.9	11.6	14.1	11.9	11.6	11.5
21	18.0	14.6	13.6	13.30	12.4	12.2	11.9	11.5	13.7	11.9	11.8	11.5
22	17.0	14.3	13.5	12.20	12.3	12.2	11.8	11.4	13.7	11.9	12.0	11.5
23	17.0	14.1	13.5	12.15	13.0	12.1	11.8	11.4	13.5	11.9	12.0	11.5
24	17.9	14.0	13.5	12.00	15.6	12.1	11.8	11.4	13.0	11.8	12.0	11.5
25	17.8	14.0	13.5	12.00	16.3	12.1	11.8	11.4	12.5	11.8	12.0	11.5
26	18.5	13.8	13.9	12.00	16.2	12.2	11.8	11.4	12.5	11.8	12.0	11.5
27	18.0	13.6	14.8	12.00	16.3	12.3	11.8	11.4	12.6	11.8	12.0	12.2
28	18.0	13.3	15.7	11.90	17.0	12.2	11.8	11.4	13.5	11.8	12.0	13.9
29	17.8		16.0	12.00	17.1	12.1	11.8	11.4	14.7	11.8	12.0	14.1
30	17.7		17.0	12.30	16.3	12.0	11.7	12.3	15.2	11.7	11.8	14.1
31	17.3		16.4		15.4		11.6	11.9		11.7		13.5
												OK

F. H.

1821E SAN. DIST. OF CHICAGO 1908 8:00 A. M. READING AT RIVERSIDE GAUGE.

Yr.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	13.1	11.7	13.6	14.9	14.2	14.5	11.7	11.4	00	0	0	0
2	13.1	11.7	14.0	15.0	14.1	13.7	11.8	11.4	00	0	0	0
3	13.0	11.7	15.0	14.5	13.9	13.1	11.8	11.4	00	0	0	0
4	13.0	11.7	16.0	14.1	13.6	12.8	12.3	00	0	0	0	0
5	13.0	12.0	16.4	13.8⅓	13.5	12.6	12.5	00	0	0	0	0
6	12.8	12.0	18.6	13.8	13.4	12.4	12.3	00	0	0	0	0
7	12.6	12.0	21.2	13.9	13.9	12.3	12.1	00	0	0	0	0
8	12.5	11.9	20.3	14.8	15.1	12.4	11.9	00	0	0	0	0
9	12.3	11.9	19.0	15.7	15.8	12.1	11.8	11.8	0	0	0	0
10	12.3	11.9	18.3	15.3	15.5	11.9	11.8	00	0	0	0	0
11	12.3	11.9	17.7	14.8	14.7	11.8	11.7	00	0	0	0	0
12	12.5	12.6	17.6⅓	14.4	14.3	11.8	11.7	11.9	0	0	0	0
13	12.8	14.9	17.4	13.9⅓	14.2	11.7	11.7	00.0	0	0	0	0
14	12.8	16.7	17.2	13.6	15.0	11.7	11.6	00	0	0	0	0
15	12.2	17.8	16.8⅓	13.2	16.0	12.4	11.6	00	0	0	0	0
16	11.9	17.5	16.6	12.9	16.3	12.9	11.6	11.9	0	0	0	0
17	11.8	17.0	16.2	12.6	16.0	12.7	11.6	11.9	0	0	0	11.4
18	11.7	16.0	15.6	12.5	15.4	11.5	11.6	11.6	0	0	0	11.4
19	11.6	16.0	15.0	12.4	15.1⅓	12.0	11.6	11.4	0	0	0	11.4
20	11.6	15.0	14.6	12.4	15.5	11.9	11.6	11.4	0	0	0	0
21	11.7	14.5	14.2	12.3	15.4	11.9	11.5⅓	11.4	0	0	0	0
22	12.0	14.5	13.9⅓	12.2	14.7	12.2	11.5⅓	00	0	0	0	0
23	12.0	13.6	13.6	12.1	14.1	11.8	11.5⅓	00	0	0	0	0
24	12.1	13.3	13.4⅓	12.1	13.6	12.3	11.4⅓	00	0	0	0	0
25	12.4	13.2	13.2	13.2	13.1⅓	12.3	11.4	00	0	0	0	0
26	12.5	13.1	13.0	13.8	12.8	12.1	11.4⅓	11.4	0	0	11.4	0
27	12.5	13.8	12.9	14.0	12.8	00	11.4⅓	00	0	0	0	0
28	12.0	13.5	14.6	14.6	12.7	11.9	11.4	00	0	0	0	0
29	12.0	13.9	15.2	14.8	14.0	00	11.4	00	0	0	0	0
30	11.9		14.6⅓	14.5	15.9	12.3	11.4	00	0	0	0	0
31	11.8		14.4		15.7		11.4	00		0		0

OK

T. B.

1821F **SANITARY DISTRICT OF CHICAGO—1909—8:00 A. M.**
READINGS RIVERSIDE GAUGE.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	00.0	11.5	14.5	11.9	21.7	11.70	12.0	00.0	00.0	0.0	0.0	12.55
2		11.6	14.45	11.85	20.9	11.7	11.75	0	00.0	0.	0.	12.6
3	00.0	11.55	14.7	11.85	20.0	11.75	11.8	0.	11.55	0.	00.	13.0
4	00.0	11.6	14.45	11.8	18.55	11.8	11.8	0.	11.60	0.	00.	13.2
5	0.	11.6	14.1	11.8	17.2	11.7	11.7	0.	11.5	0.	0.	13.2
6	0	11.8	13.65	11.8	15.95	11.7	11.6	0.	00.0	0	0.	14.35
7	0	12.3	13.45	13.0	14.80	11.65	11.55	0.	0.	0	0	14.7
8	0	12.7	13.3	13.1	14.15	12.8	11.5	0.	0.	0	11.5	14.2
9	0	13.0	13.4	12.6	13.85	14.6	11.5	0	0	0	11.7	13.7
10	0	15.2	14.0	12.4	13.8	14.7	11.5	11.5	0.	0.	11.8	13.9
11	0	14.5	13.9	12.2	13.5	14.0	11.5	11.5	0	0	11.7	13.65
12	0	13.9	13.6	12.1	13.15	13.2	11.5	11.6	0	0	11.7	13.4
13	0	13.25	13.4	13.5	12.85	12.7	11.5	11.7	0	0	11.65	13.7
14	0	12.8	13.3	14.5	12.65	12.4	11.5	12.75	0	0	11.8	14.6
15	0	12.8	13.1	13.9	12.9	12.2	11.5	13.0	0	0	11.9	14.9
16	0	12.9	12.9	13.5	13.0	12.0	11.5	14.95	0	0	11.9	15.15
17	0	12.7	12.6	13.9	12.6	11.9	11.5	14.95	0	0	12.7	14.65
18	0	12.3	12.5	13.9	12.35	11.8	11.5	13.9	0	0	13.2	14.6
19	0	12.0	12.4	15.8	12.2	11.7	11.6	13.2	0	0	12.8	14.3
20	0	12.1	12.7	16.7	12.05	11.6	11.6	12.6	0	0	12.6	14.2
21	0	12.3	12.6	16.0	11.90	11.6	11.5	12.3	0	0	12.4	13.85
22	0	12.8	12.4	16.45	11.80	11.6	11.5	12.05	11.5	0	12.75	13.4
23	11.4	13.8	12.2	16.40	11.8	11.75	11.5	11.9	11.6	11.5	14.2	13.2
24	11.5	15.05	12.2	15.75	11.65	11.9	11.5	11.8	11.9	11.5	14.3	12.9
25	11.9	16.4	12.25	15.1	11.6	12.2	11.5	11.7	11.9	0.0	13.85	12.85
26	12.4	15.5	12.2	14.4	11.75	12.7	11.5	11.7	11.8	0	13.4	12.8
27	11.9	14.6	12.15	14.0	12.0	13.3	11.45	11.7	11.6	0	13.05	12.7
28	11.8	14.5	12.2	13.8	12.1	12.8	11.45	11.6	11.6	0	12.8	12.7
29	12.0		12.15	14.8	12.0	12.4	11.4	11.5	11.5	0	12.7	12.7
30	12.6		12.05	19.2	11.8	12.1	11.4	11.5	11.5	0	12.6	12.65
31	11.8		11.95		11.7		11.4	11.5		0		12.65

OK

T. B.

1821G SANITARY DISTRICT OF CHICAGO—1910—8 A. M. READING AT RIVERSIDE GAUGE.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	12.6	12.90	13.35	12.20	14.30	13.40	11.55	0	0	0	0	0
2	12.55	12.80	13.70	12.10	15.45	13.15	11.55	0	0	0	0	0
3	12.45	12.90	14.755	12.00	17.68	13.10	11.55	0	0	0	0	0
4	12.45	13.00	16.00	12.00	17.45	13.15	11.55	0	11.40	0	0	0
5	12.40	13.10	17.35	12.10	16.20	13.20	11.55	0	11.40	0	0	0
6	12.40	13.25	19.	12.25	14.95	13.15	11.55	0	11.50	0	0	0
7	12.45	13.10	20.10	12.20	14.00	13.00	11.55	0	11.40	0	0	0
8	12.40	12.80	19.50	12.10	13.75	12.85	11.55	0	11.40	0	0	0
9	12.35	12.70	19.20	12.00	13.90	12.70	11.55	0	0	0	0	0
10	12.40	12.65	18.75	11.95	13.70	12.55	11.50	0	0	0	0	0
11	12.35	12.60	18.30	11.90	13.30	12.40	11.45	0	0	0	0	0
12	12.40	12.50	17.75	11.90	13.00	12.30	11.45	0	11.45	0	0	0
13	12.40	12.45	17.40	11.95	12.90	12.10	11.45	0	0	0	0	0
14	12.40	12.40	16.85	11.90	12.60	12.05	11.40	0	0	0	0	0
15	12.35	12.30	16.30	11.85	12.45	12.00	11.40	0	0	0	0	0
16	12.30	13.00	15.50	11.80	12.30	11.90	11.70	0	0	0	0	0
17	12.30	13.40	14.90	11.90	12.30	11.85	11.80	0	0	0	0	0
18	12.50	13.80	14.75	12.00	12.20	11.80	11.95	0	0	0	0	0
19	12.60	13.40	14.45	12.10	12.20	11.80	11.55	0	0	0	0	0
20	12.60	12.95	14.30	12.00	12.10	11.75	11.50	0	0	0	0	0
21	12.65	12.60	14.30	11.90	12.05	11.65	11.45	0	0	0	0	0
22	12.70	12.50	13.95	11.90	12.30	11.60	0	0	0	0	0	0
23	12.70	12.95	13.70	12.30	13.20	11.60	0	11.60	0	0	0	0
24	12.70	12.80	13.40	13.50	14.50	11.55	0	11.40	0	11.55	0	0
25	12.70	12.60	13.15	13.70	14.60	11.55	0	0	0	0	0	0
26	12.75	12.60	12.95	14.80	14.15	11.50	0	0	0	0	0	0
27	12.80	12.80	12.80	15.98	13.65	11.50	0	0	0	0	0	0
28	12.85	13.05	12.65	15.85	13.20	11.50	0	0	0	0	0	0
29	12.85		12.50	15.10	13.15	11.55	0	0	0	0	0	0
30	12.90		12.40	14.40	13.45	11.60	0	0	0	0	0	0
31	12.90		12.30		13.50			0		0		0

OK

T. B.

1822 Mr. COOLEY (continuing): The papers which I have marked "High water marks Desplaines river, Summit to Joliet, rise of June 1892," and also another one entitled "High water marks between Bridgeport and Summit, rise of June 1892," were furnished by me.

Q. What do they contain?

Objected to, as the papers will themselves show what they contain.

COUNSEL FOR GOVERNMENT. In reply to the objection of counsel I will say that these papers are brought here for the purpose of meeting the objection that the high water marks of 1892 as shown on Parry Exhibit 2, were objected to for the reason that the original data were not furnished.

The WITNESS. The levels of these gauge readings were taken by E. J. Ward and M. J. Cross, and that is an abstract of the record made by Mr. Ward for the Sanitary District, of which I was furnished a copy. They were given to me as soon after they were compiled, sometime between 1892 and 1895. I have forgotten the exact date. They have been in my files ever since.

1823 Mr. CRESSY. If counsel for the defendant objects to them as not being properly certified, we can have them certified by the Sanitary District which has the original copies.

COUNSEL FOR DEFENDANT. I object to the tables on the ground that no proper foundation has been laid; it does not appear that they are original records or that they are observations obtained at the time, and further, if they are offered to meet the objection made by me this morning, as I assume from counsel's statement they are, that they do not meet that objection because they do not supply the data referred to in that objection.

The WITNESS. The profile entitled "Parry's Exhibit 2" was not drawn to show the profile of the Chicago river below Bridgeport. The gentlemen who made this summary of the high water marks for the flood of 1892 were employed by the Sanitary District, and made a survey of the Mud Lake

1824 region and Desplaines river in reference to the investigation of the flood of 1892. As to whether these two documents shown me are a correct and accurate copy of the report which those gentlemen made to the Sanitary District, I would say it is the report itself. That is the document which is filed in the record of the Sanitary District giving the results of their work in determining those high water marks between Bridgeport and Joliet. These notes fully describe the points and location of these places where the high water mark was taken.

Objected to on the ground that it does not appear that the witness has any personal knowledge of where they were taken.

The WITNESS. A surveyor with these reports before him would be able to go to the point where the high water mark was located at the time this investigation was made, and locate that high water mark. These documents have been used by the Sanitary District.

Objected to; incompetent, irrelevant and immaterial.

1826 Whereupon, after some colloquy between counsel, it was agreed that if these documents were certified to by

the Sanitary District no question would be raised as to their being authentic copies or reproductions of what is in the Sanitary District's office.

The WITNESS. As to whether I have anything further to say in reference to the statement that the "Desplaines river practically goes dry above Joliet," I would say I think I have stated already that the volume of water gets down to a very small sum but never goes wholly dry. In other
1827 words, what I mean by that is this: that the water that is left would not be useful for a commercial purpose, that is, turning a mill or for navigation or supplying a great city. That is what I meant by the use of the word "practically."

Q. Mr. Cooley, referring to a certain Act of the legislature of the 6th of December, 1907, concerning which you were asked on cross-examination at page 58 of the abstract in the State case, entitled:

"A bill for an Act recognizing the Desplaines and Illinois rivers as navigable streams and to prevent obstructions being placed therein, and remove obstructions therein now existing.

Sec. 1. Be it enacted by the People of the State of Illinois represented in the General Assembly: That the Desplaines and Illinois rivers throughout their courses, from and below the water plant of the main channel of the Sanitary District of Chicago, in the township of Lockport, at or near Lockport, in the County of Will, are hereby recognized as, and are hereby declared to be navigable streams; and it is made the special duty
1828 of the Governor and of the Attorney General to prevent the erection of any structure in or across said stream, without explicit authority from the General Assembly; and the Governor and Attorney General are hereby authorized and directed to take the necessary legal action or actions to remove all and every obstruction now existing in said rivers that in anywise interfere with the intent and purpose of this Act."

Can you state, Mr. Cooley, as to whether there was ever any Act passed by the Legislature of Illinois referring to this section of the Desplaines river?

Objected to as incompetent, irrelevant and immaterial.

A. Not in reference to this section, so far as I know.

Q. Was there an Act, Mr. Cooley, passed by the legisla-

ture of the State of Illinois in reference to any other portion, of the Desplaines river?

Objected to as incompetent, irrelevant and immaterial.

A. There was an Act passed in 1839, I think; there was.

Q. Is that the Act of February 28, 1839, entitled: "An Act declaring the Desplaines river a navigable stream," which provided as follows:

"Sec. 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly, that the Desplaines river from the point where it most nearly
1829 connects itself with the Illinois and Michigan Canal, to its source, within the boundaries of this State are hereby declared a navigable stream, and shall be deemed and held a public highway, and shall be and remain free, open and unobstructed from said point of connection with said canal to its utmost limits within this state, for the passage of all boats and water craft of every description."

Objected to as incompetent, irrelevant and immaterial.

A. That is the Act that I had in mind.

Mr. Cooley (continuing): The point mentioned, to wit, the point where it most nearly connects itself with the Illinois and Michigan Canal, I think that is intended to mean at Summit, in the vicinity of the range line at Summit. I am fa-
1830 miliar with the history and plans for the Illinois and Michigan Canal, as originally contemplated, prior to the Act of 1839.

Q. You may state where it was contemplated prior to 1839 that the Illinois and Michigan Canal should come most nearly to the Desplaines river.

Objected to as incompetent, irrelevant and immaterial, and that the witness, if he has any knowledge upon the subject, does not have personal knowledge; but that his testimony would be a conclusion based on documents not produced in evidence.

A. The original location of the canal from Bridgeport to the Desplaines Valley, and down the Desplaines Valley, was never changed, and construction was actually begun thereon in 1836; and going from Bridgeport southwesterly the canal first approaches the Desplaines river and most nearly approaches it perhaps in the vicinity of Summit. My information in reference to the original location of the Illinois and

Michigan Canal was obtained from the State reports and state maps that show that location. Also in government reports of the United States.

1831 Q. Is there any question among engineers in reference to the location of the Illinois and Michigan Canal as originally contemplated?

Objected to as incompetent, irrelevant and immaterial.

A. There is not.

Q. Mr. Cooley, when the legislature of 1839 passed this bill, having in mind the original survey which has been introduced in evidence, the original field notes of John Walls which have been introduced in evidence, and the topographical conditions of the Desplaines River Valley as they existed in a state of nature before that state of nature was changed by the construction of the Illinois and Michigan Canal and other obstructions, in your opinion as an expert engineer why was the act of 1839 made to apply to the Desplaines river from Summit north, and not apply from the Desplaines river from Summit to its mouth?

Objected to as incompetent, irrelevant and immaterial, and as being based upon data which is not identified or indicated, and so far as appears, does not appear in evidence, and as calling for the conclusion of the witness, in the matter upon which he is not qualified to testify.

1832 A. The Desplaines river was meandered by John Walls and by another surveyor, from the mouth up to the township line at Lyons and there designated in the notes as the head of navigation, and the Act of 1839 was intended to extend the idea of the character of a navigable stream up to the Wisconsin line or to recognize its character from that point.

Q. If you were to add to the question as originally asked you, Mr. Cooley, the additional fact that the testimony of historical experts shows that the river was actualy used for some portions of each year, between the point known as Summit and the mouth of the river, what would you say as to how the legislature considered the Desplaines river as being navigable or not, between Summit and its mouth?

Same objection.

A. The legislature, I take it, recognized the historical
1833 fact in the matter of the use of that part of the stream from time immemorial and no declaration in regard to

that portion was germane; but it was germane in regard to the portion above the township line at the point noted by John Walls, or above Summit.

Counsel for the government asked to have the record corrected to show that where Mr. Cooley was employed by the American Surety Company, it should read *National* Surety Company. Upon being asked if this was correct the witness replied "That is correct."

Mr. COOLEY (continuing): The contract was between the United States through the War Department, and the Savage Construction Company, for which the National Surety Company was bondsman, and issue arose through the failure of the Savage Construction Company to complete its contract, and I was employed by the National Surety Company to go over the matter and see if an adjustment could not be reached. I was on the opposite side, in that adjustment, to the United States.

1834 On page 1629 of the cross-examination, where occurs a hypothetical question in which the following assumption was made; first, that the depth of the water in the river at Riverside, as shown by the gauge, is the depth from Riverside down to the mouth,—that assumption is not correct. In the first place, the volume of water passing Riverside does not prevail down to the City of Joliet, but in part passes out to Lake Michigan by way of the Mud Lake region. In the second place, the river at the ruling points has not the same range for the same volume of water; in other words, the stage of water differs from point to point for a given volume.

Q. Referring to a volume of 305 second feet as the Riverside gauge, Mr. Cooley, which corresponds to an elevation of 13 feet on the gauge, what would be the volume at the mouth of the river?

Objected to as asking the conclusion of the witness on matter as to which no foundation has been laid.

A. 686 second feet.

Q. What would be the depth of that volume at the mouth of the river?

Same objection.

A. About fifteen inches, as I remember it.

Q. What would be the depth at Treat's Island, Mr. Cooley, on that same volume, 305 second feet at Riverside?

A. Over twenty inches.

As to whether I verified the statement I made with reference to the mouth of the river, I would say 14.4 is what I have here in my notes.

Q. Referring to the hypothetical questions that were put to you on cross-examination in reference to doubling, trebling and quadrupling the width, and the effect of such upon the depth, do these assumptions prove anything in reference to the actual conditions of the Desplaines river?

Objected to as incompetent, immaterial and irrelevant.

1836 A. They do not. Because the ruling points of the river do not for any distance which would determine levels in the stream correspond to such assumption. There is a variation between the different ruling points. An engineer to determine the depth on a given width at any point in the river like the Desplaines would proceed to form a stage profile of the river, taking a high water stage or some other stage for which the volume could be definitely ascertained, and then construct at each of these points a relation which would show the depth for other volumes of water.

Q. Does what you have said in reference to the doubling, trebling and quadrupling the width apply to the assumptions which were made in reference to varying the slope and the effect of that upon the depth?

Objected to as incompetent, irrelevant and immaterial.

A. It does. Those rules only apply to theoretical channels.

1837 In reference to my general knowledge in regard to the deforestation of the Desplaines river valley, I would say I was familiar with the Desplaines river basin generally during the period from 1885 up to 1892, in which period I was making investigations thereof, and casually since. At that time all the timber that was valuable for commercial purposes, lumbering purposes, had been cut away from the Desplaines river. It had been the source of fuel for the people living in the Desplaines river basin and had been cut away for cordwood, and was largely the source of fuel up to that time, and is to a certain extent since, and I think that the basin corresponds substantially to the history of the removal of forest areas in other parts of northern Illinois, perhaps more so in view of its proximity to Chicago and to many suburban towns. I examined at the time I made these studies all the available data, all the source materials I could find, all the maps and other information that could

1838 be gathered, and made extensive inquiries at the time.

Q. Is the result of your inquiries the statement contained in the Water Supplies of Illinois?

Objected to as incompetent, immaterial and irrelevant.

A. That is in part, up to that time, and as a preliminary or outline report that contained the results of my studies up to that time; but those studies were prosecuted later with a view to a later report and were supplemented by topographical maps which were produced by the Sanitary District covering a considerable portion of the basin.

Q. On page 70 of this Water Supplies of Illinois pamphlet, being one of the pages offered in evidence this morning, you state: "The lower part of the water shed was originally one-fourth to one-third timber, increasing northward to one-third to one-half the area." Is that statement the result of the investigation which you have just now referred to?

Objected to as incompetent, immaterial and irrelevant.

A. Yes.

Q. Was that statement correct when made?

Same objection.

A. It was to the best of my knowledge and belief.

1839 Q. Have your later investigations confirmed or disproved that statement as therein contained?

Same objection.

A. Confirmed it.

Q. I would like you to say in reference to the amount of swamp control which now exists on the Kankakee basin, and what formerly existed there.

Objected to as incompetent, irrelevant and immaterial, and as not specifying or pointing out the data upon which the conclusion asked is based.

1840 A. There has been a considerable drainage of the uplands and smaller swamp areas and a margining in of the great swamp; but the general body of the great swamps in Indiana is substantially unchanged according to the best of my information.

In the preparation of this report entitled "Water Supplies of Illinois" I did gather all the information I could find and prepared a report on the Kankakee river, the same as I did for the Desplaines river, as a part of the general scheme of taking up all the tributaries of the Illinois river in succession. The basin of the Kankakee river itself lies further out from the rim ridge of the lake and like the Fox river basin has a larger proportion of permeable ground than basins within that rim, like the Desplaines basin. Beneath the

swamp itself there is a deep deposit for which various depths
are stated, from 8 to 15 or 20 feet of sand, and this
1841 sandy soil is relied upon by those who are engaged in
the drainage of the basin to maintain the flow in the Kankakee river basin. In that report I think I gave an opinion that the drainage out of the swamps would be disastrous to the flow of the stream; but I have stated in my cross-examination that I have modified my views upon that subject somewhat in view of this permeable ground beneath the swamp. The permeability of the soil generally in the Desplaines river basin is much less than in the Kankakee river basin, the surface soil being much less friable than that of the Kankakee river basin. A proportion of the Desplaines river basin can be compared as to this swamp control in the original condition, with the Kankakee, and I have assumed that one-third of that above Summit could be so compared.

Q. In making your comparison on direct examination, on which you were examined, I will ask you as to whether that comparison which you made referred to extreme conditions in the Desplaines and Kankakee, or whether it referred to the normal conditions?

Objected to, as the comparison speaks for itself.

1842 A. It referred substantially to the normal conditions. I mean by normal conditions the ordinary flow of eight months and the usual low water, and the extreme low water as reported by Mr. S. E. Waters, engineer for the Kankakee company from a record between 1871 and 1883.

The following passage on page 79 of the Water Supply of Illinois was thereupon read by counsel for the government:

> "Owing to the area of the basin and its large proportion of flat ground and marsh, floods culminate slowly. At Wilmington, the floods generally take two and a half to three days to culminate after heavy general precipitation. The following extract from a letter from Mr. E. S. Waters, engineer of the Waterpower Company at Wilmington for over twelve years, and who was interested in observing such matters, covers all that need be said upon the matter at this time."

Then omitting a paragraph:

> "A heavy rain that fills the marshes of the Upper Kankakee will keep up a good supply for six weeks even in time of extreme drought. These marshes act as a large gathering ground, and the exit from the marshes

being narrow and the stream very crooked, the water is impounded and the marsh acts as a reservoir.

It is to be inferred from this letter and also from the
1843 general conditions that the Upper Kankakee does not contribute to the maximum volume, but comes in later to prolong the rise.

The extreme low water at Wilmington for the twelve years preceding 1883, from data furnished by Mr. Waters, was 420 feet per second (25,200 feet per minute). This, however, continued for less than one week. The usual low water run is given at 1,300 cubic feet per second (78,000 cubic feet per minute), and the common run for eight months in the year does not fall below 2,350 cubic feet per second (141,000 feet per minute)." is the passage referred to.

1844 When I say that deforestation tends to create a deficiency in the water supply of rivers, I mean that the deficiency is due to the fact that forests consume less water than grass and pasture lands and tilled grounds or crops. A forest of coniferous or evergreen trees will utilize or consume in transpiration 6 to 8 inches in depth; a forest of deciduous trees, those which drop their leaves annually, will consume 9 to 11 inches in depth. A growth of small grain, like wheat, oats and barley, will consume about 12 inches of water. A growth of corn consumes 16 inches. Grass lands consume 12 inches and upwards, according to the amount they can make available, and for that reason the forests consuming less water, leaves more to run away.

As to whether forests have a regulative effect upon the flow of streams, I would say that they are a part of the reservoirs that are provided by nature, and like the reservoirs have regulative effect due to the presence of the forest litter by which the water is held and obstructed in its passage to the
1845 streams, and it flows away more slowly than on open ground, unless the open ground would be very highly permeable or well tilled.

Referring to the transastions of the American Society of Civil Engineers, Volume 62, March, 1909, page 1098, entitled "Forests and Reservoirs in their relation to stream flow, with particular reference to navigable rivers, by H. M. Chittenden," on cross-examination I testified that I had not read those papers. Since the cross-examination closed I have read the original paper of Mr. Chittenden and discussions thereof, but only in part the closing paper of Mr. Chittenden.

On cross-examination I was asked as to whether or not it was a fact that out of 21 discussions of this paper 13 of them agreed with Mr. Chittenden in his deductions. Having in mind the reading of these discussions, I will now state that that is not correct. There are 22 papers and not 21, which discuss the paper by Mr. Chittenden.

Q. How many of those agree with Mr. Chittenden?

Objected to, on the ground that the papers speak for themselves.

1846 COUNSEL FOR THE GOVERNMENT. In view of the question of counsel for the defendant I request an answer to this question.

A. There are seven of these papers which hold generally for the view expressed by Colonel Chittenden, some of them with qualifications; there are twelve of the papers which hold substantially against the views of Mr. Chittenden; there are three papers which may be said to not express themselves or be neutral upon the subject matter.

On page 246 of Mr. Chittenden's papers, he makes the following statement:

"The commonly accepted opinion is that forests have a beneficial influence on stream flows:

(1) By storing the waters from rain and melting snow in the bed of humus that develops under forest cover, preventing their rapid rush to the streams and paying them out gradually afterwards, thus acting as true reservoirs in equalizing the runoff.

(2) By retarding the snow-melting in the spring and prolonging the runoff from that source.

(3) By increasing precipitation.

(4) By preventing erosion of the soil on steep slopes and thereby protecting watercourses, canals, reservoirs and similar works from accumulation of silt."

1847 I would say that Mr. Chittenden states it correctly as the commonly accepted view. Mr. Chittenden on page 249 of the paper in question makes the following statement:

"It is true, therefore, as popularly understood, that, in periods of ordinary rainfall with sufficient intervals for the forest bed to dry out somewhat, forests do exert a regulative force upon runoff. They modify freshets and torrents, and prolong the runoff after storms have passed, and thus realize in greater or less perfection the commonly accepted theory."

Q. Wherein, Mr. Cooley, does Colonel Chittenden differ

from the views that you have expressed here on direct examination in reference to the effect of the forests upon the condition of the water in streams tributary therefrom?

A. On page 287:

"Reservoirs in Their Relation to Stream Flow.

Under this heading artificial reservoirs alone are included. Natural reservoirs of various kinds exist nearly everywhere, and exert a profound influence upon stream flow. The ground is the most important of these, ab-
1848 sorbing on an average probably one-third of the total rainfall. Natural lakes are great regulators, the St. Lawrence system being the most perfect example. Forests are effective reservoirs at certain seasons. Swamps and low-lying grounds along river courses, like the great flood basins of the Sacramento and the Mississippi are, in their natural state, enormous reservoirs which greatly reduce the flood flow of the river channels. Snowdrifts, particularly the great drifts of the mountains, are splendid reservoirs. The streams themselves have immense storage capacity; for example, the Mississippi within levees stores at least 9,000 billion cu. ft. of water from Cairo to the Gulf, between extreme high and low-water stages. All these reservoirs and many of less importance are ever active in regulating the flow of streams. Without them precipitation would flow off as fast as it arrives, and our greatest floods would be magnified many times."

The WITNESS. That is part of Mr. Chittenden's original paper. On page 263 Colonel Chittenden says:

"Measurements of the Monongahela river, at Brownsville, in 1838 and 1856, low-water years gave discharges of 75 and 23 cu. ft. per sec., respectively. It is quite certain that the river has not fallen so low in late years.
1849 At Pittsburgh in 1895 (the dryest season in recent years), it fell to 160 feet."

Whereupon counsel for the defendant objected to the question, on the ground that the differences will appear from the article of Col. Chittenden and from the testimony of Mr. Cooley, and that his conclusion is not competent.

Whereupon counsel for the government offered in evidence the passages referred to, which passages were objected to unless the entire document is put in.

COUNSEL FOR THE GOVERNMENT. In view of the fact that

counsel for defendant saw fit to cross-examine Mr. Cooley by using this article and referring to certain portions of it, we claim the right to refer to other portions to show that the contentions of counsel with reference to the showing of Mr. Chittenden's article are not correct.

Whereupon the original question was reread.

1850 COUNSEL FOR DEFENDANT. The objection stands.

A. Mr. Chittenden's article is largely devoted to a discussion of the extreme of high and low water, which it is conceded are not affected to a material extent by the acts of man. In other words, it has already been stated in my testimony that conditions arise at rare intervals where a control may be entirely exhausted; and in other rare intervals where control may be exceeded, although there is a difference of opinion as to the latter point.

Q. Now, Mr. Cooley, you may refer to any other passage or passages contained in this discussion which have to do with the point which you made on direct examination, that the forests tend to prolong the stages of water in the river concerning which these papers were used for the purpose of cross-examining and refuting that direct testimony of yours.

Objected to as incompetent, immaterial and irrelevant, and calling for conclusions of the witness which are not competent.

A. The passages have already been cited from Col-
1851 onel Chittenden which make it evident, and it is so specifically stated, that he does not refer to the usual effect of forests under usual conditions which are the conditions which we are concerned about particularly in this discussion.

Mr. COOLEY (continuing): Colonel Chittenden does not treat the subject of permeable ground in a characteristic way so as to develop what his full idea is upon that
1852 subject. In our own case we have very little permeable ground, being a very dense clay subsoil, more characteristic in that respect than in any other basin in Illinois, or of any with which I am familiar. Mr. Chittenden makes no reference to a very important consideration, which affects run-off in all kinds of basins, and that is the frozen ground proposition.

The flood of 1887 in the Desplaines river was a frozen ground flood. The characteristics of the flood of 1867 show that that was also probably a frozen ground flood. This

frozen ground does not occur to the same extent, in fact is generally absent in forests.

His statement also in regard to the effects of forests on run-off from melting snow, I would take issue with directly, both in the mountains and in the humid regions. I have had experience for four years as consulting engineer of the Union Water Company at Denver in connection with the run-off of the eastern slope of the Rocky mountains in Colorado from the Cache Va Pourdre river to the Arkansas, and also in a less degree of the western slope of the Rocky Mountains in the Middle Park and Grand River Basin. I think the best summary that can be given of the conditions there is
1853 represented in the citation given by Professor Swain from an article of L. G. Carpenter of Ft. Collins, Colorado, who is a professor in the agricultural college there, who has been connected with the irrigation system of Colorado for many years and who was the expert for the State of Colorado in the Colorado, Kansas case. I have known Professor Carpenter for a long time and I believe he is the most competent man to express a view in regard to the conditions existing in the mountains beyond the plains.

The view I am now referring to is given in Mr. Swain's discussion, reading from page 374:

> "The writer has not had the opportunity to study to any extent the conditions in the Rocky Mountains, but he observes that Professor L. G. Carpenter, of the Colorado State Agricultural College—than whom there is no more competent authority—in his paper on 'Forests and Snow,' comes to the following conclusions, among others:
>
> (a) The greater the amount of forest cover the less
> 1854 violent the daily fluctuation, the more uniform the flow throughout the day and throughout the season, and the later the stream maintains its flow.
>
> (b) The loss of the forest cover means more violent fluctuation during the day, greater difficulty in regulating the headgates and keeping a uniform flow in ditches, and hence an additional difficulty in the economic distribution of water. Also the water runs off sooner, hence the streams drop earlier in the summer, and on account of the lessening of the springs, the smaller is the winter flow.
>
> (c) The preservation of the forest is an absolute necessity for the interest of irrigated agriculture."

That is the passage I refer to and from my experience in that region I think it is the best statement that I have seen and I would adopt it as my own.

Now, in regard to snow fall conditions in western New York, which is typical of the humid region, I was born in that country on a farm and worked on that farm until my 24th year, and am familiar with every variety of condition and of drainage and of snow in the forests that has developed during my early lifetime on that farm and in that part of the country. Chittenden remarks, which is true, that it is the most characteristic snow region in the United States, usually having 90 days of sleighing.

For twelve or fifteen years of that time I was in the
1855 woods engaged in the various operations of woodcraft,
getting out cordwood and merchantable timber, and other wood for fuel, and in the sugar bush, where we made from 1,500 to 1,800 pounds of sugar every year out of one tract of woods, and am familiar from day to day with the conditions in those woods so far as snow is concerned, from the time that the temperature rose at noonday high enough to start the sap above the freezing point in the maple trees, up to the time that the buds made the sap bitter and were opening in the later spring; and can testify from personal experience as to the conditions under which that snow ran off.

Colonel Chittenden is absolutely wrong in his diagnosis of the effects of eastern forests, or forests in the humid regions so far as snow is concerned.

I am also familiar with the run-off from the forests and the conditions of the soil at other seasons of the year, and of ground waters.

There is given in Professor Swain's article also the experience in the Merrimac river basin upon the same subject.

Professor Swain has been connected with the Boston School of Technology, I think, and it was his father who was the
inventor of the Swain Turbine, for a long time con-
1856 nected with the water power development of New Eng-
land. I do not know so much about this Swain, except that he has an excellent reputation.

Mr. Gifford Pinchot contributes to those papers. He is the official authority in the United States, and among engineers has usually been regarded as expressing his views conservatively. I have read Mr. Pinchot's discussion of Mr. Chittendens' paper. He does not agree with Colonel Chittenden

upon his broad proposition. I do not know that he differs from him upon the general questions of these extremes;
1857 upon the general effects of forests he controverts Mr. Chittenden. He makes the following statement on page
458 in referring to a quotation which Colonel Chittenden makes of a prior statement of Mr. Pinchot's:

"Unfortunately, Colonel Chittenden has failed to gather from these statements what seems to the speaker to be their obvious meaning.

The illustration used is a fair description of one, but only one, of the essential functions of the forest floor, and due notice was given to that effect. The forest floor offers a physical obstruction to the rapid escape of water over the surface, and thus itself provides to some extent a small storage reservoir. Colonel Chittenden admits this influence for average conditions; indeed, it it a matter of such common observation as to be indisputable. The practical value of this influence may be little or much, depending on the character and amount of precipitation and the thickness of the undergrowth, decaying litter and humus on the ground.

There is, however, another function of the forest floor which in practical value far surpasses this one. The forest floor acts on the soil itself to multiply its absorptive capacity. The humus, which by natural action is being constantly mixed with the upper layers of mineral soil, greatly increases its receptive and retentive
1858 power, while the deep-penetrating roots also open passages through which water readily passes into the great reservoir of ground-water.

When the importance of the forest to ground storage is once realized, a very large part of Colonel Chittenden's argument is seen to rest on a fundamental misconception."

Counsel for the government thereupon stated that they offered these passages in evidence with the privilege of counsel for defendant to insert any other portions that they may deem material, and that the offer was made of only limited portions for the purpose of saving the record. The fol-
1859 lowing passage on page 463 from Gifford Pinchot's discussion was also offered in evidence:

"It is true that, because the sun is excluded in a dense forest, melting begins later than in the open, and Col-

onel Chittenden correctly states a universally known fact when he says that, 'even after the ground in the open is entirely bare, except under the drifts, the forest areas may still be covered with an unbroken layer of snow.' Why? Simply because it is colder in the forest. It is colder when the process of melting begins, it is colder until the snow is gone in the open. The forest consequently acts in exactly the same way as the gulch on the north mountain exposure. It catches the average amount of snow, and holds it up till the melting time in the open is past. If the melting went on as fast in the forest as it does in the open, the discharge of water would be greater, considering the whole watershed, and floods would thereby be intensified."

And on page 464, the following:

"The only condition under which the melting, for like conditions, is anything like as fast as in the open is during a warm rain, such as often accompanies the 'chinook' winds in the western part of the United States. When this happens, the effect is the same on the snowdrift in the gulch and on the snow blanket in the forest. It melts at a most rapid rate. Once melted, there is this
1860 difference: Water from the snowdrift is at once in the channel ready to swell the floods, while water from the snow blanket is caught up in the lawer of leaves and humus overlying a porous soil, and is retarded at every moment in its downhill course. A portion seeps down through the humus into the stream, a large or even larger part goes into the earth and does not reappear for weeks or months."

Also the following on page 466:

"A word in summing up: If the speaker's points are well taken and have been made plain, Colonel Chittenden's fundamental conception as to the forest floor and its influence is mistaken. His idea that records in the United States do not show an increase in the frequency of floods and low water is mistaken. His idea that the critical point to be considered is flood heights, and not flood frequencies, is mistaken. And his conception of forestry, of the functions and management of the forest, beyond its relations to water supply, is so fundamentally mistaken that the speaker might discuss it at far greater length without exhausting the mistakes."

Also the following passage from Mr. Labelle's paper, which has some bearing upon conditions in Illinois, on page 442, as follows:

1861 "The investigation of the causes of the decreased flow of Rock river, Wisconsin, belongs to the second class. The watershed has an area of about 3,600 sq. miles, is slow-spilling, and has a comparatively high retentivity.

A good proportion of its swampy lands and small lakes has been drained; and the custom of laying tile and other drains and of cutting ditches prevails throughout the region. This has resulted in a more rapid delivery of the rain water into the streams. The rainfall has been decreasing, since 1885. The forests have decreased from 75% to 30% of the whole area. Mr. Schwarz, the author of the pamphlet, states that the most obvious explanation for the smaller quantity of water annually carried by Rock River is the diminution of rainfall; he ascribes also a certain amount of influence to the draining operations above mentioned. The principal body of water which has been drained is the Horicon Marsh, at the upper end of the main branch of the river. This marsh was dammed in 1846 for water-power; it has an area of 73 sq. miles, and its catchment amounts to approximately 400 sq. miles, or one-ninth of the watershed. Later, the dam was removed, and the tract was allowed to revert to its original state and was put under cultivation. In spite of the conditions just described, the pamphlet attributes largely to deforestation the reduction in the stream flow.

1862 It seems to the writer that the conditions obtaining in the watershed were well enough known to permit of making some kind of an estimate of the percentage of decrease of run-off due to:

1—Smaller rainfall;

2—Drainage of swamps, low lands, and the Horicon Marsh;

3—Increased demand of cultivated lands;

4—Deforestation.

The sum of the first three factors subtracted from the total decrease in run-off as computed from gauging operations would give the fourth factor, or the percentage of decrease due to deforestation. Until this com-

putation is made, all estimates of this fourth factor are mere speculation."

The WITNESS. That refers to the watershed of the Rock river in Wisconsin. The total watershed of the Rock river is about 11,000 square miles. That covers about one-third of it.

As to the standing among engineers in reference to the subject of forestry of Mr. Labelle, I would say I do not know. What directed my attention was the quotation regarding the Rock river which was within proximity to this region and represents a more friable soil than in the Desplaines river basin.

Whereupon the following excerpts from page 310, which is from the paper of Colonel Chittenden, was read into the record, as follows:

1863 "In recommending this plan to the Department, it was pointed out that the true advantage of the government even apart from the revenue expected, favored its adoption. It simplified the whole relation between the Government and the consumer. If private interests were to build the plant, they would acquire vested rights which would always stand in the way of future control, and lead to complications if it should become necessary to terminate the arrangement. With the plant in the possession of the Government, and the users standing simply in the relation of lessees for a limited period, without great initial expense on their part, and with freedom on the part of the Government to control the arrangement without the complication of private ownership, the whole plan would stand on a simple, practical, business basis. This view prevailed with the Department and is now before Congress for adoption, being possibly a departure in this line."

COUNSEL FOR THE GOVERNMENT. There may be one or two other passages that I shall want to offer in evidence here because we realize there are over three hundred pages here that we have had to read very hastily, and I will reserve the right to make additions to those.

Q. Referring to a document entitled: "Improvement of Non-Tidal Rivers. Memoirs by S. Janicki, Engineer, Director of the Moskva Navigation Co: L. Jacquet, Chief Engineer of Ponts et Chaussees; A. Pasqueau, Engineer of Ponts et Chaussees. Translated by Bvt. Colonel Wm. E. Merrill, U.

S. A., Major, Corps of Engineers. Washington: Government Printing Office, 1881," what do you know of the standing of these engineers?

A. They are among the eminent engineers of the
1866 French Ponts et Chaussees, which has charge of the waterways of France. Colonel Merrill translated a number of French works, this collection among the number, and generally did that work for the engineer corps when foreign documents were to be reprinted, and it is regarded as a faithful translation.

Whereupon counsel for the government offered page 96 of the pamphlet, which offer was objected to as incompetent, immaterial, irrelevant and on the ground that no foundation laid.

The WITNESS. I do not know whether Mr. Jacquet is living today or not.

The said passage so offered in evidence reads as follows:

1867 "In 1858 calculations were based upon a minimum discharge of 9,536 cubic feet. In 1870, 8,123 cubic feet was allowed. On November 16, 1874, the minimum discharge fell to 7,415 cubic feet, as was proved by the different gaugings made at that time. The minimum discharge of the Rhone is, therefore, rapidly diminishing on account of the removal of the forests, or the diking of its affluents, or some other cause, and everything tends to prove that this reduction of the minimum discharge, which has been observed upon almost all the rivers of France, will continue beyond the limits already known."

Q. What does this show, Mr. Cooley, in reference to the agreement of other engineers with the principle of forest affect upon the run-off of streams?

Objected to as incompetent, immaterial and irrelevant.

A. It shows that in the opinion of the profession throughout the world generally the effect of forests and the other effects of inhabitation are affecting the flow of water in the rivers. In reference to the cross-examination where I was asked in reference to the part which I played in the legislation that has been passed by the legislature of Illinois, and in reference to the various associations of the State of Illinois and of the nation and the City of Chicago which have had to do with considering the feasibility and practica-
1868 bility of making the deep waterway from Chicago to the Gulf of Mexico by way of the Sanitary District chan-

nel, the Desplaines river, the Illinois river and the Mississippi river, I have been connected with these projects in a professional way as engineer, assistant engineer, chief engineer and consulting engineer.

Referring to the project of the Economy Light and Power Company of the construction of a dam at the mouth of the Desplaines river, which is the dam in dispute in this litigation, there were overtures made by the Economy Light and Power Company for the purpose of soliciting my services as an expert engineer on their behalf. At the time that I was engaged in writing the state report published in 1907, Mr. John L. Norton communicated with me and asked me if my services could be secured as a consulting engineer for the Economy Light and Power Company, and I replied that I was engaged by the state and was then writing a report
1869 for the state and could not entertain the proposition.

I do not know specifically what position Mr. Norton occupied in reference to the Economy Light and Power Company. I had no other negotiations except a come-back from Mr. Norton later, who sought to ascertain if I would be available after my report had been written, and I did receive a further communication from Mr. Norton to which I stated that I would not be available for services with the Economy Light & Power Company. As to whether there were any other negotiations had between me and other persons in reference to the Economy Light & Power Company, I would say that Mr. Munroe came to my office once with a set of blueprints. That is the same Mr. Charles A. Munroe who is now present in court. I believe at that time he was secretary of the Economy Light & Power Company. As to what conversations or negotiations I had with Mr. Munroe with reference to the matter, I would say, Mr. Munroe as I remember it, did not seek at that time to engage my services, but did lay his blueprints and plans before me and we had some
1870 discussion in respect to them. I think there were two visits, but I won't be absolutely sure about that.

Q. Did you ever accept any employment for the Economy Light and Power Company?

Objected to, on the ground that there is no evidence that the witness was ever offered any employment by the Economy Light & Power Co.

A. I was approached on another occasion, or several times, in fact, by Mr. James A. Sedden.

Q. Just a moment; in reference to the Economy Light and Power Company?

A. I don't know that I was.

Q. Did Mr. John L. Norton seek to engage your services for the Economy Light & Power Company.

Objected to as incompetent, immaterial and irrelevant, and on the ground that it has not been shown that Mr. Norton had any connection with the Economy Light & Power Co. or that he had any authority to make any such proposition.

A. He did.

Q. What did Mr. Norton say to you the first time he called upon you?

1871 A. I did not particularly charge my mind with the conversation and cannot repeat the same. I can only give the substance of it, which I have already stated, that he made the general inquiry as to whether my services could be secured for the company or not.

Q. Mr. Cooley, have you ever been approached by any other interests other than the Economy Light and Power Company in reference to projects for the location of dams in the Desplaines river, and if so, by whom?

Objected to as incompetent, immaterial and irrelevant.

A. I have. By Mr. James A. Sedden.

Q. You may explain what project he sought to interest you in or to secure your services for.

Objected to as incompetent, immaterial and irrelevant.

A. Mr. Sedden was employed by the interests that were seeking to build a dam above the head of Lake Joliet and repeatedly solicited me to become interested in the matter and to accept employment in connection with that project as consulting engineer.

Q. Did you or did you not accept such employment?

1872 Objected to as incompetent, immaterial and irrelevant.

A. I did not.

Q. Have you ever been approached by any other parties in reference to other projects for the erection of dams in the Desplaines river?

Same objection.

A. Not in regard to the Desplaines river.

Q. In regard to the Illinois river?

A. I was approached in regard to the construction of a dam immediately above the City of Ottawa.

Q. Did you accept that employment?

Same objection.

A. I did not.

The WITNESS (continuing): Referring to the testimony on cross-examination, in which I have stated that the point of no discharge at Riverside is 11.4, and further stated that at that time there was a low dam of sod and stone just below the Rivreside gauge which has since been washed out so that the point of no discharge has been lowered a little below 11.4 feet, on page 1619 of my cross-examination I was asked this question: "It is a fact, is it not, that there was a condition which changed from time to time; a portion of 1873 the time it was four-tenths of a foot lower, and that is shown by the elevations at the top of the table," and I answered "That I don't know; I have not examined that," I have examined these tables contained in House Report 263 and find the assumption contained in the question is not correct, namely, that a portion of the time it was four-tenths of a foot lower.

Whereupon counsel for the government offered in evidence in that connection the following paragraph from House Report 263, page 511:

> "The 'new gauge,' established on January 3, 1887, was set with its zero at Chicago city datum, or elevation 587.04 feet, Memphis datum. It has been the intention since that time to maintain it at that elevation, but during a portion of the time it was 0.04 feet lower, as shown by the elevations at the top of the tables."

The difference of 0.04 would not make such an appreciable difference in the totals that I have offered here in evidence in reference to the number of days at which the water was at a certain elevation in the Riverside gauge as to justify recasting them. The 0.04 of a foot difference in the low water elevation, to wit, 11.04 feet, would not have any material effect whatever upon the number of days at which the gauge stood 11.85, 12.4 feet, 13 feet, 13.8 feet or 18 feet. My table was prepared for the purpose of ascertaining how many days in the years the flow was at the elevations that I have just mentioned, and to give the average result. The condition of this sod dam I have mentioned as being just below the gauge, when the water stood on the gauge at 12.4 or above, would not affect the elevation; it would not affect the record. The dam itself would be drowned out. On cross-examination I was asked concerning the period of ice. I have data in reference to how

long the period of duration of ice is in the vicinity of Chicago, which duration is fifty to sixty days. As to how much of this occurs during the period of law water in the Desplaines river, when the flow is less than 100 feet per second at Riverside,
I would say about one-third of it as a general statement.
1875 The period in which the Illinois and Michigan Canal was
officially opened has no bearing upon the length of time in which rivers and lakes can be used, and are actually used, because as is quite customary with artificial canals, especially boat canals and not ship canals, they have a fixed time of opening and a fixed time of closing in order to govern the employment of men upon the canal and for the purpose of cleaning the canal out in the spring. The water is not usually retained in the canal during the winter, but in large canals like the Canadian canals and the "Soo" or river canals, that is not done.

Re-cross Examination.

Mr. COOLEY (continuing): As to when Mr. Munroe called at my office and showed me certain blue prints, my impression is that it was after Mr. Norton had approached me in 1906 or
1907 in the winter. My recollection is that Mr. Norton
1876 approached me in December, 1906, and later in Jannary
or February, 1907. My recollection is that Mr. Munroe approached me after Mr. Norton did, but I am not positive about it. I did not charge my mind particularly with those interviews. Mr. Sedden approached me at various times from 1902 or 1903 up to sometime in 1906, according to my impression. As to whom he claimed to represent when he approached me, I would say for a time it was the people that were interested in the construction of the dam above Lake Joliet. I do not know that I can mention the names; I think Gaylord was among the number. I cannot say as to whether Mr. Sedden approached me for the Economy Light & Power Company. He stated to me in his later conversations that he represented a syndicate that was organized to exploit the whole river, by private parties. As to whether I know that the Economy Light & Power Company acquired no interest in these premises until December, 1906, I would say I didn't know anything about the relation of the Economy Light and Power Company
on this subject until July, 1907, I think. It is true that
1877 Mr. Norton approached me some time in 1906. As to
whether at that time I did not know anything about the Economy Light and Power Company having any interest in

this property, I will say I will modify that statement in this way: I did know there was an Economy Light and Power Company, but I did not know their relation to this particular project at that time. I did not learn of their relations until the time that I stated, sometime in July, I think. Mr. Norton wanted me to become consulting engineer of the Economy Light and Power Company for the purpose of building a dam at the mouth of the Desplaines river. As to whether I know that at that time the Economy Light & Power Company had not acquired any interest in the property at the mouth of the Desplaines river, I would say I don't know anything about that; I only know what was said to me. My statement that until July, 1907, I did not know of the Economy Light and Power Company's connection with that proposition. was
1878 modified to the effect that I did not know that the people who were behind the Edison and Commonwealth Company were interested in the Economy Light and Power Company until that time. As to whether I know that the Commonwealth-Edison Company had nothing to do with this proposition, I will say it was stated to me specifically that they did not, but that the people behind those companies did. Mr. W. G. Beale stated that to me in the summer of 1907. As to whether anybody stated that to me prior to 1906 or in 1906, that either the Edison or Commonwealth or Economy had anything to do with the power property at Dresden Heights, I would say my impression is that Mr. Norton stated it in December, 1906. I would not be absolutely sure whether Mr. Norton approached me in December, 1906, or January, 1907. He approached me twice during the period when I was preparing the state report, and that is the way I recall it.
1879 As to whether Mr. Munroe approached me at any time after December, 1906, I would say I said that I was not specifi , but my impression was it was after the Norton interview. I am quite sure he did approach me after 1904. As to whether he made any overtures to me of any sort as to employment by him or by the Economy Light and Power Company, I would say I think not at that time. My impression is that after the Norton matter and after the report was submitted to the legislature along about that time, that I met Mr. Munroe at Springfield and he remarked to me that I had made a mistake in not being with their company. We had some conversation, not very much, and I suggested to him

that in view of his relations to the river, that it would be better for his proposition if he got out of Springfield.

1880 COUNSEL FOR DEFENDANT. I move to strike that out of the record—no, let it stand as showing the animus of the witness.

COUNSEL FOR GOVERNMENT. I move to strike out the remark of counsel as to showing the animus of the witness.

Mr. COOLEY (continuing): As to whether Mr. Munroe stated to me at Springfield it would have been better for me if I had gone with them or accepted their offer, I would say I think he suggested, as I stated, that I had made a mistake in not going with the company. That conversation took place, as I remember it, in the lobby or on the same floor, between the House of Representatives and the Senate in the State House. I do not think there was anybody present at that interview except myself and Mr. Munroe; it was just casual remark. As to whether it is not true that the only time any remarks passed between me and Mr. Munroe at Springfield was a casual meeting between myself, Mr. Munroe and Mr. Gilbert E. Porter, I would say I don't know that I know Mr. Porter. I remember Mr. Porter as being present at the State case, but I did

1881 not know Mr. Porter prior to that trial. I have no recollection of ever meeting him prior to that trial. As to whether he was with Mr. Munroe at the conversation I spoke of at Springfield, I will say I don't think there was anybody present. As to whether, aside from this casual meeting and this casual remark which I dropped to Mr. Munroe there is any time or place when Mr. Munroe indicated in any way a desire to employ me for the Economy Light and Power Company, I will say I don't believe so. As I say, the whole matter was something that I did not charge my mind with and should not have referred to here. When he brought the blue prints to my office in 1904, he said they were for a dam at the mouth of the Desplaines river and he seemed to have gotten the impression in his mind that I was opposed to the construction of a dam at that point and wished to discuss it with me, and asked my objections to that location and I did

1882 look at the blueprints that he had, or the blueprint which showed the location of the dam, and did discuss it with him to a limited extent. Nothing was said to me in regard to any employment of myself by the Economy Light and Power Company or by himself. As to whether I said anything to him as to whether or not the dam would interfere with any plans for the making of a deep waterway down the

Desplaines river, I did not tell him it would not interfere with such plans. I said that there were 12 of the contributors to that discussion who disagreed with Mr. Chittenden. The way I read the papers those twelve are: Collingwood, Child, Le-
Baron, North, Smith, Swain, Willis, Leighton, Pickett,
1883 McMath, Fletcher and Pinchot. As to whether I claim
that Mr. Seddon had anything to do with the Economy Light and Power Company, I would say I don't know whether his engagement lapped over onto the Economy Light and Power Company or not. I do not know exactly when the Economy Light and Power Company took hold of the proposition. I do know that as early as 1904 the interests down there had secured some sort of permit from the canal authorities. I do not know that the Economy Light and Power Company had anything to do with obtaining that permit. I have stated I do not know exactly when they took hold. I could not say without further reflection when Mr. Seddon got through with his overtures.

D. H. DUGAN, called as a witness on behalf of the Government, testified as follows:

Direct Examination by Mr. Cressy.

I am twenty-eight years of age, am a civil engineer and temporarily reside in Chicago. Am employed by the Sanitary District of Chicago. I have been practicing the profession of civil engineer for the past ten years approximately. Principally in topographical surveys. For several years I was with the United States geological survey, making water power surveys in Wisconsin, during the progress of which work I surveyed and mapped about 200 miles of the Wisconsin river
and several of its tributaries, and also surveyed and
1895 mapped about 75 miles, I think, it was, of the Peshtigo
river in Marinette County, the northeastern part of Wisconsin. The Eau Claire river, which is a tributary of the Wisconsin river, was also surveyed and mapped. I conducted surveys and investigations at several different times under Professor Mead. One occasion was a detailed survey of a portion of the Peshtigo river, and on another occasion it was surveys and investigations in connection with the reconstruction of the water supply system at Decatur, Illinois.

I entered the employe of the Sanitary District in Novem-

ber, 1906, and have been employed by them continuously from that time. I am now assistant engineer. The class of work I have been employed upon has been surveys, topographical surveys and hydrographic surveys of the Illinois river. My work
has embraced the entire valley, of the Illinois river, and
1896 a portion of the Desplaines river, and the tributaries of
the Illinois river also; in addition to the surveys and maps which have been made, we have also conducted a variety of investigations pertinent to the overflow of the bottom lands of the Illinois river. In my work I have had occasion to consider the reports made by surveyors and have had occasion to make diagrams and construct plats and work of that nature. I am familiar with the survey of the Illinois river made by the United States Government from 1902 which is reported in House Report 263, being what is commonly known as the report of the 14 foot waterway, published in 1905.

I have made a study of the maps, sheets 55, 56 and 57, now shown me, and as to the conditions as shown upon them, the three maps embrace the valley of the Desplaines river from
the neighborhood of Lockport to a point near the mouth
1897 of the Mazon river, which is not far east of Morris.
These maps are what are commonly termed topographical maps, and show the typical features of the valley of the river; show the elevation of the ground; show the location of various buildings, fence lines, and in addition to that have drawn upon them contour lines or lines of equal elevation. The contours on these maps are one foot contours; that is the difference in elevation between two successive contours is one foot. The channel of the river is shown, its width and its depth is shown in figures representing the soundings, as they are called, and these represent the depth of the water below
the known water surface. One of the maps accompany
1898 this report of 1905. I have platted or drawn upon
tracing cloth, the cross sections of the Desplaines river at various points, between McDonough street in Joliet, and the E., J. & E. railroad bridge at Devine. These cross-sections depict the cross-section of the river at intervals of about 500 feet, and are taken at points or shown at points where soundings were taken in the river during the progress of the Government survey in 1902 and 1904.

In addition to the maps, the only other document or diagram, which was used, was the Government profile which was constructed by the Government engineers in connection with that same survey of 1902 and 1904. The reason for the neces-

sity of using the profile was to obtain the elevation of the water surface to which the soundings are referred, the soundings being shown on the map in feet below a certain water surface, and that water surface is shown upon the profits. That profile accompanies House Report No. 263.

A progressive cross-section is simply a diagram showing a number of cross-sections of, for instance, the river in this
case; the cross-sections being arranged in some logical
1899 order, proceeding either down or up the stream, being
taken at certain intervals, certain known intervals. The cross-section will show the depth at all points of the stream transversely, the width of the stream, and the elevation of various portions of the bed of the stream, and also the elevation of the water surface to which the soundings which were taken referred. I would say that the progressive cross-section shows the depth of the water at any point where a sounding was taken at right angles to the stream and running from one bank to the other bank. It shows the shallowest as well as the deepest portion. The progressive cross-sections show graph-
ically the data incorporated on Government sheet 55.
1900 In the construction of these cross-sections I used no
other data or information, other than that contained in Government sheets 55, 56, and 57 of the report of 1905, and the Government profile.

The water surface shown on the progressive cross-sections I prepared,—refer to the water surface profile after the introduction of the waters of Lake Michigan into the Desplaines river. The low water surface shown on the cross-section is the low water surface of 1901. The Lake Michigan water was introduced into the Desplaines river by the Sanitary District in January, 1900.

NOTE. (Whereupon the progressive cross-section maps were produced by witness.)

Cross-Examination by Mr. Scott.

THE WITNESS. These cross-sections are taken every five hundred feet beginning at the McDonough street bridge and
running to the E., J. & E. bridge at Devine. That is
1901 about seventeen miles. There are indications as to each
of these cross-sections. Right at the cross-section, just above the lines which represent the water surface is a number. That number appears upon the map and is what is known as the stationing. This first cross-section shown upon

the progressive cross-sections were platted from the ones shown on map No. 57, and represents a cross-section of the river through station 1517 plus 100 feet.

This first station is down at McDonough street. At station 1517 McDonough street, you will observe 1516 right there, but a thousand feet from that 1517. The plus 100 is 100 feet up stream. The pluses are always up stream. They proceed with the station. The cross-sections were not exactly 500 feet apart in each instance. There is the portion between the difference between 500 feet and the exact distance between the sounding lines. You see these cross-sections are platted from measurements taken across the stream; in sounding the stream it was not feasible and it was not convenient and it was not intended to take cross-sections exactly every 500 feet, but those sounding were taken at approximately that interval, and of course located by measurements and referred to this stationing, and this stationing represents the exact position of those cross-sections with reference to the channel of the river, the stationing being measured from the mouth of the river at Grafton, and each station being a thousand feet long. The distance to a cross-section which did not lie exactly upon a station of course had to be obtained by measurements with a scale, the maps being drawn to scale, being platted to scale.

These cross-sections are at the points where soundings
1903 are made on sheets 55, 56 and 57. And these cross-
sections indicate in here where they are in reference to those soundings. You can pick out any cross-section here and find the soundings from which it was platted on the map. In selecting the places where I make the cross-sections, I was governed by the soundings as they appear upon the map. The intervals at which soundings appear upon the map would vary. I would say they are not farther apart than 500 feet, approximately 500 feet. The cross-sections show the cross-section at every point where the soundings were taken as they appear upon that map and were taken exactly where those were platted. At some place soundings on that map
show that soundings were taken at intervals of much
1904 less than 500 feet. We took this approximately every
500 feet, that was the only governing feature; not the only governing feature there—I might say they were taken every 500 feet; if at 500 feet there was a sounding line, or if a string of soundings had been taken. The nearest sounding was taken which would place the interval at about 500 feet. In some places it was a trifle more and in some places a trifle

less. The Government offered in evidence this progressive cross-section plat and asked to have it marked "Dugan Exhibit 1."

1905 Objected to as incompetent, immaterial and irrelevant, and specific objection is made on the ground that it does not purport to represent conditions in the river in the natural condition of the river but as affected by the introduction of water from Lake Michigan; it is further objected to on the ground that it does not show the cross-section at all points where soundings appeared upon the map from which it is purported to be based.

COUNSEL FOR GOVERNMENT. In answer to the objection we offered the plat not for the purpose of showing the condition in a state of nature, but as showing the condition of the river after the introduction of the Sanitary District water.

(Said plat so offered and identified was marked "Dugan Exhibit 1.")

(Said Dugan Exhibit 1 appears in Appendix, p. .....)

COUNSEL FOR DEFENDANT. May it be understood that all questions based upon the map in question and upon this Exhibit 1 of Mr. Dugan's testimony are objected to as incompetent, immaterial and irrelevant, and as predicated upon conditions not existing in a state of nature.

The WITNESS. The shallowest portion of the Des-
1906 plaines river based upon examination of the map, sheets 55, 56 and 57, of the Government survey of 1902 and 1904, show the limiting cross-section to be at the head of Treat's Island, where the deepest point in the limiting cross-section is 2.4 below the low water of 1901. That answer is confined to the Desplaines river between McDonough street, Joliet, and the E., J. & E. railroad bridge. Outside of those limits I would have to examine the map.

1907 In constructing these cross-sections I indicated what portion of the channel is described or shown in reference to islands. In the case where I show across the sheet four sections, as to whether that would mean that there were islands between those sections I would say that the progressive cross-sections are platted proceeding down the stream and are shown on the sheet from left to right as the river flows that way.

Referring to the cross-section labelled 1512 plus 650, in which I see the word "Island," in that case I have shown the location of the island in the stream. At Treat's Island I have shown the channel which passes to the left of the island, and

by that I mean the channel which is on the left-hand side when you are facing down stream the way the water flows. That would be east and south, southeast, channel, I believe. I guess the river flows pretty near southwest from there. In all these cross-sections it probably would be well for me to interject this explanation: as you look at the cross-sections on the sheet, the portion of the cross-section on your right hand side represents the right hand side of the stream,
1908 as you face the way the water flows.

The cross-section which shows the point at Treat's Island that I refer to is this one here, the 1479 plus 130. I am able to state from an examination of sheet 55 as to what extent the depth of 2.4 feet extends from the point where this cross-section is made. That depth obtains across that cross-section of the river for a distance of practically 200 feet. As to whether I am able to state at what point is the deepest cross-section of the Desplaines river between McDonough street and the E., J. & E. bridge, I would say that the deepest portion is at Lake Joliet and near the lower end of the lake I think there is a depth of 19.6 feet if I recollect rightly, below the low water of 1901.

Whereupon counsel for the Government asked the witness as to whether he was able to state from his experience in the Sanitary District as to whether the low water of 1901 shown by the maps and Government profiles was a record low water; which question was objected to by counsel for the defendant; whereupon the following question was put to the witness:
1909 "Q. What investigation have you made in reference to ascertaining that fact, Mr. Dugan?

A. From my experience in the Illinois valley, and my familiarity with various reports and investigations carried on by others, in particular the survey of 1902 and 1904, I would quote that report as saying that the 1901 low water was a record low water."

Whereupon counsel for the defendant moved to strike out that portion of the answer beginning "I would quote," as not responsive to the question.

The WITNESS (continuing): As to whether I have made a personal examination of the physical conditions of the Desplaines river from its mouth to McDonough street, examining the gauge readings as recorded by the Sanitary District or any other data, I would say I have examined the gauge records as observed on the Desplaines river between the points mentioned, and, as I said before, I have also examined various

reports upon that stream. I have also had some personal experience with the river.

Q. You feel, Mr. Dugan, that from the examination that you have made of the gauge records and other data referred to the conditions of the Desplaines river from 1900 to
1910 the present time that if a question were asked you in your official capacity as assistant engineer, as to what was the record low water of the Desplaines river, would you be able to give it?

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. Yes, sir.

Q. You may now state, Mr. Dugan, as to whether the low water as shown in the House Report No. 263, as being the low water of 1901, as to whether or not that was a record low water.

Objected to on the ground that the witness has testified that his first employment with the Sanitary District was in 1906 and he has shown no knowledge of conditions of his own knowledge prior to that time; also as incompetent, immaterial and irrelevant, and calling for a conclusion of the witness upon data which has not been defined or referred to.

The WITNESS. It was a record low water.

Q. Are you able to state from the investigation that you have made of the gauge readings and other data referred to the Desplaines river in connection with your duties as
1911 assistant engineer of the Sanitary District, what has been the maximum rise in the Desplaines river above that low water at or near the mouth of the river?

The WITNESS. Yes, I can tell you that.

Q. What is it?

Prior objection repeated.

The WITNESS. The record shows that the rise of the mouth is about in the neighborhood of 12 feet above the low water of 1901.

Q. The average or noraml stage of the river would lie where, Mr. Dugan referring to the depth as shown on the progressive cross-section of this maximum height of 12 feet?

Prior objection repeated.

1912 The WITNESS. The average stage would be somewhere between the record low and the extreme high water.

Q. Would you say that these progressive cross-sections show a normal or average stage?

Objection repeated.

The WITNESS. No, sir, they show the depths in an extreme low water stage.

Q. And the average stages or normal stages of the Desplaines river at these points where you have made the cross sections, how would they be in reference to the depth?

Prior objection repeated.

A. At average stages the river is deeper than is shown on the cross sections.

The WITNESS (continuing): The cross sections show the narrowest channel to be on the south side or on the left hand channel at Treat's Island and the width at that point is about 110 feet, the depth being 3.4 feet at the low water stage of
1901, and that point is over close to the Millsdale high-
1914 way bridge on the south side of Treat's Island.

The widest portion of the river between McDonough street and the E. J. & E. Bridge is in Lake Joliet and near Patterson Island. The width in that neighborhood is almost a quarter of a mile, I believe, in low water. Counting the McDonough and the E. J. & E. Bridge, there are five bridges across the Desplaines river in all between McDonough street and the E. J. & E. bridge, viz., McDonough street bridge, Brandon's road bridge, Millsdale highway bridge, Smith's bridge, and the E. J. & E. railroad bridge; that is proceeding down stream, and they are all highway bridges with the exception of the last mentioned one.

I am connected with the engineering department of the Sanitary District as Assistant Engineer; the engineering department of the Sanitary District employ gauge readers at
different points along the Desplaines river. At present
1915 gauges are maintained by the Sanitary District and by the department in which I am employed at Brandon's road bridge, at Alexander's at the mouth of Jackson creek, at the side of the Kankakee feeder acqueduct, and at the E. J. & E. bridge. These various gauges have been read for various lengths of time; the one at the mouth of Jackson creek being the oldest, and all of them having been read continuously during the last three or four years. By continuously I mean an observation at least every day. The reports of these gauge readings come under my observation. They are compiled under my supervision. Based on these gauge records, I have constructed a chart showing the average stage of the river at the mouth of Jackson creek since 1903.

The low water surface of 1901 was at that point as
1916 shown by the sheet 55. It is 502.4 Memphis datum.

The E. J. & E. railroad bridge is located in the neighborhood of a mile and a half, I think it is, below the mouth of the Desplaines river. The bridges on the Desplaines river between McDonough street and the mouth of the river are four, including the McDonough street bridge. The Memphis datum was the plan or reference that was used by the Government engineers in making the survey of 1902 on the Desplaines river.

COUNSEL FOR GOVERNMENT. Q. You may state, Mr. Dugan, basing your answer upon your information gained as supervisor of the gauge readings, what was the average elevation for the water surface at Alexander's guage for the year 1903.

Objected to as incompetent, immaterial and irrelevant; and as applying to the river when not in a condition of nature, and for the further reason that it calls for conclusions and computations upon data not produced or offered in evidence.

1917 The WITNESS. The gauge readings show the average elevation during the year 1903 to have been 504.68, Memphis datum.

DEFENDANT'S COUNSEL. If this data is produced so we may be able to examine it, we will not insist, so far as we know now, upon its appearing in the record, nor insist upon the objection in so far as concerns the lack of data.

1918 The WITNESS. The average elevation for the year 1904 was 505.79 Memphis datum. For the year 1905 504.23; for the year 1906 504.52; for the year 1907 1919 504.55; for the year 1908 505.18; for the year 1909 504.53.

Objected to as incompetent, immaterial and irrelevant, and as applying to the river when not in a condition of nature; and for the further reason that it calls 1920 for conclusions and computations upon data not produced or offered in evidence. If this data is produced so we may be able to examine it, we will not insist, so far as we know now, upon its appearing in the record, nor insist upon the objection in so far as concerns the lack of data.

Q. You may state the depth of water, Mr. Dugan, along the thalweg of the river opposite the Alexander gauge in the year 1901.

Same objection.

The WITNESS. Based upon the map the depth there would be shown at about 8½ feet.

Q. State the depth for each year as shown by the average river stage from 1903 to 1909 inclusive at this thalweg of the river opposite the Alexander gauge.

Objected to as incompetent, immaterial and irrelevant, and as applying to the river when not in a condition of nature; and for the further reason that it calls for conclusions and computations upon data not produced or offered in evidence. If this data is produced so we may be able to examine it, we will not insist, so far as we know now, upon its appearing in the record, nor insist upon the objection in so far as concerns the lack of data.

The WITNESS. The depth in 1903, which is dependent upon the gauge records, average 10½ feet; 1904, 11½ feet; 1905, 1906 and 1907 the average depth was practically 10½ feet; 1908 averaged about 11 feet; 1909, 10½ feet. These are approximate within a few inches.

1921 The thalweg of a stream would be the thread of deepest depth and traverses the bed of the river longitudinally, following the deepest portion. I have constructed a profile showing the channel depths along the Desplaines river, along this thalweg, based upon the soundings shown in sheets 55, 56 and 57, and the low water surface of 1901 as indicated on the Government profile. I have that here and will produce it.

The Government offered this in evidence and asked to have it marked.

Cross-Examination by Mr. Scott.

The WITNESS. The soundings which disclose this bottom of the river were taken subsequent to the introduction into the Desplaines river of that flow from Lake Michigan by the Sanitary District; but what changes of course have occurred

1922 in the bed of the river between 1900 and the time these soundings were taken I could not say, and the profile does not show. The profile shows conditions in a state of nature. The bed of the river would still remain in a state of nature, even though an addition of a large quantity of water from Lake Michigan was turned in. That would certainly be true where there was rock and might be true in other places.

COUNSEL FOR GOVERNMENT. The Government does not offer

this map as showing the condition in a state of nature. It offers it as showing the conditions since the turning in of the Sanitary District water. The Government offered this in evidence and asked to have it marked Dugan's Exhibit 2.

1923 DEFENDANT'S COUNSEL. Statement of counsel for the United States objected to on the ground that profile is not offered to show the condition in a state of nature and on the ground that it is incompetent, immaterial and irrelevant to any issue in this case.

(Which said map so offered in evidence was marked "Dugan Exhibit 2.")

Direct Examiantion by Mr. Cressy.

The Government asked leave to substitute a blueprint for this map.

The WITNESS. The map now shown me correctly shows the thalweg of the river from McDonough street through Joliet to the mouth, as shown by the soundings from sheets 55, 56 and 57, House Document 263, and the Government profile of 1901.

Q. What has been the condition of low water, Mr. Dugan, basing your answer upon your knowledge of the gauge readings, comparing 1901 with the period since that time.

Objected to as incompetent, irrelevant and immaterial and as not showing the condition is a state of nature.

The WITNESS. The water has been higher generally. None of the low waters have been as low as the low waters of 1901.

1924 *Cross-Examination by Mr. Scott.*

The WITNESS. The soundings shown upon the plate of 1902 and 1904 surveys took no account of boulders in determining depths, or in according depths.

The report states that the soundings on the surveys of 1902 and 1904 were referred to the low water of 1901. By low water of record, I mean, that the lowest water of record since January, 1900, was 1901. I think there has been no low water record as low as that since. In the first instance, the report of 1902 and 1904 specifically says that that is the lowest water since the introduction of the Sanitary District

waters into the river, and subsequent to the time of that report I have had access to the gauge records showing the stage of the river every day, and we have found no water
1925 lower than the 1901 water. I have used the knowledge of all that data in arriving at the conclusion I have given here. I have never computed the discharge in cubic feet per minute at the low water of 1901. The gauge records do not show the discharge. You cannot determine from the gauge readings alone what the discharge was, and you cannot from the gauge reading and the cross section at the point where the gauge is located. There are several different methods of computing the low water discharge but you cannot do it by taking the cross section and the elevation of the water.

Q. State one of the methods of computing it?

That is all objected to on the ground it is not proper cross-examination.

1926 The WITNESS. One of the most common ways of computing or ascertaining the discharge of a certain point on a river where a gauge is maintained, is to ascertain the height of the water, and then from previous measurements which have been made, to determine the exact discharge of that river at that elevation to get it, by a table which will show the number of cubic feet per minute or per second which are flowing past that point at that elevation; but of course that depends upon measurements made by some one else at some previous time, and by that method if there had been no previous measurements, you could not ascertain the discharge at all. The discharge of a river for the first time can be measured or estimated. It can be measured with a current meter by measuring the cross section and measuring the velocity of the water.

1927 You measure directly the velocity,—or rather indirectly you measure the velocity and measure the cross sectional area directly, and knowing the velocity with which the water is going by and the area which is passing, the product, of course, would be the volume,—your velocity times your area, gives the volume.

COUNSEL FOR GOVERNMENT. It is understood that objection of the Government extends to all testimony of Mr. Dugan of this character.

The WITNESS. Velocity in feet per second times the area in square feet would equal the discharge in cubic feet per second. No other elements have to be taken into account. You do not have to consider the wet perimeter in that case. You

do, however, in an indirect fashion, but not as a wet perimeter. Of course, if you know the area and know the shape of the cross section, why you could determine the wet
1928 perimeter undoubtedly. I think there have been tables prepared for the Alexander gauge. I have made no investigations of those tables as to the low water since 1901. There are three bridges not including the McDonough street bridge, between it and the E. J. & E. bridge.

Q. How many bridges are there above the McDonough street bridge in Joliet?

Objected to on the ground it is not proper cross-examination, in view of the fact that the witness testified only between McDonough street and the mouth of the river.

The WITNESS. I don't know for certain. I think there are four or five.

1929 Q. What is the character of the McDonough street bridge? What is the structure?

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. It is a fixed span, I think, it is a highway bridge. I am not familiar with the plans and construction of these several bridges below McDonough street.

1930 B. F. THOMAS, called as a witness on behalf of the Government, testified as follows:

Direct Examination by Mr. Cressy.

My full name is Benjamin Franklin Thomas. I reside in Cincinnati. I am principal assistant engineer in the second Cincinnati district, United States. I have charge of the Muskingum, Big Sandy and the Kentucky rivers, the construction and design of locks and dams on those rivers and the maintenance of them; general charge. That work is done under the War Department of the United States and particularly under the United States Engineer's office at Cincinnati.

1931 The Kentucky river is situated in Kentucky and comes into the Ohio at Carrollton, 75 miles below Cincinnati. The Big Sandy river is on the line between Kentucky and West Virginia and enters the Ohio 151 miles above Cincinnati. The Muskingum river runs through the State

of Ohio and enters the Ohio river at a point something like 300 miles, I should say, above Cincinnati. Those rivers are used for navigation purposes. They are all slack water rivers. I mean by slack water rivers, locks and dams. They have locks and dams to permit navigation. The Big Sandy is not completed yet, and the Kentucky is not quite completed. I have been connected with the Big Sandy since 1883, and the other two about six years. When I say slack water navigation or navigation by locks and dams, I mean that during the entire course of each year the boats use the locks in going up on the Kentucky river and on the Muskingum. On the Big Sandy, the dams are movable and are lowered

1932 during times when there is sufficient water to navigate without them. I have designed and built five movable dams of the Needle type on the Big Sandy river, and I had charge of eight on the Great Kanawha river in West Virginia; and I also worked nearly two years on No. 6 Ohio river at Beaver, Pennsylvania, which is also a movable dam; and I have been connected with the study and design of movable dams since I have been with the Government. I was instructed to make that a specialty and did so.

I first began with the Government in 1883, and I immediately got the French (there was nothing then in English); I immediately got all the French works and had them translated and helped them translate them myself so as to start at the beginning and make a study of that one thing. We only had one movable dam at that time in the United States, so that I rather made a specialty of movable dams and wrote one book on that subject—a 200 page book in 1898.

1933 Q. You may tell us, in a general way, what are the conditions which exist upon the three rivers which you have mentioned in reference to navigation and its difficulties and how these dams have been used to overcome those difficulties.

Objected to as incompetent, immaterial and irrelevant.

The Witness. Previous to the construction of works for navigation like locks and dams, these rivers were only capable of navigation during freshets, that is, through the winter season and spring; they consisted of a series of pools and shoals, of natural pools. The shoals and bars at the lower ends of the pools are bars sometimes of rock, sometimes of gravel, but when water is scarce, the boats cannot go up over these as a rule because of lack of depth and also because of the

scattering rocks that may be in these shoals. The rivers are taken in this shape by the Government and we clean out all the shoals so as to make it navigable by open river navigation without locks and dams at all. Then after a time when money is made available by Congress, we build locks and dams at intervals ranging from four or five miles to twenty miles apart. These dams raise the water over these shoals and keep a permanent depth so that navigation may go on.

1934 The steamboats pass from one pool to the other through the locks. Where the dams are stationary this passing through the locks is a necessity the year around. They can do nothing else; they cannot go over the dams. Where the dams are movable they are lowered upon the approach of a flood, say when there is seven feet of water which is sufficient for navigation, or six feet, the movable dams are drawn down and then navigation does not have to take itself through the lock at all. The average slope of these rivers is from seven to eight inches to the mile, to two feet to the mile; but we have short stretches of river in which the slopes may be as much as fifteen feet to the mile, 15.2 feet. But, those are only short stretches. The velocities on those rivers vary from three miles an hour to eight or nine miles an hour at different points.

The discharge on the Big Sandy river has been as low as 48 cubic feet a second; that is the lowest I have measured myself and I think that is the lowest it has ever been. On the Muskingum river it is 400 feet a second. On the Kentucky river it is 300 feet a second. Those are the summer or low water discharges, say between August and November,

1935 extreme low. The general discharge is as much as 500 cubic feet a second. The general discharge in summer at a three foot stage will be as much as three hundred feet a second. That would apply to any one of the three but especially I was applying it to the Big Sandy which has the least discharge of any. On theh Muskingum the discharge will always be 400 feet. The discharge of the Ohio is 1100 cubic feet per second, extreme low stage, minimum.

I have made an inspection of the Desplaines river from Joliet, Illinois, to its mouth. I went over it on the 28th of December, 1910. On that trip with me there was Mr. Cooley,

1936 Mr. Meigs, Captain Brown, Captain Ferris, Mr. Cressy and the engineer of the Sanitary District, Mr. Heilbron.

We crossed the bridges in Joliet, I believe there were four; then we went down to Brandon's or Brandon's mill,

whichever it is, and then we went on down to Smith's and it seems to me there was one more bridge or there was one some place where the piers were standing that we examined, we examined it anyway, where there used to be a viaduct—no, an acqueduct across the river. That is the Kankakee feeder acqueduct. Then we went to the place where there was a cofferdam out in the river near the Kankakee. Went out through a field to where the Economy Light and Power Company had their plant for construction.

Q. Did you also examine the river at the head of Treat's Island?

Objected to as leading.

The WITNESS. We went out through a field there to the head of the island and walked down the river from that point, the heading of the island to the road bridge.

Q. I will ask you as to whether you examined the
1937 river at a point where the Du Page enters into the Desplaines river, on that day.

Objected to as leading.

The WITNESS. Yes, sir.

Q. Mr. Thomas, what was the condition of the stage of the river on that day, basing your answer upon whatever you may have observed in reference to the condition of the banks or the stage of the water.

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. The river was lower than the ordinary stage of the water. I judge this by the dead grass. There was a space between the grass and the water which had evidently been covered before. That is a condition quite common on our slack waters. Whenever the pools are down below normal a foot or two, you can tell on the bank, because there is no vegetation between that and the normal stage, and that was the condition here. Just how much I don't know, but I should say something over a foot lower than the grass line. Probably from a foot to two feet lower.

On that trip I made an investigation to determine as to what was the velocity at which the water was traveling at those various points, which investigation consisted of throwing sticks into the stream and approximately timing
1938 these sticks over a certain distance, say three hundred feet; the measurement of the three hundred feet also being approximate. That is a method that is used by engineers in general for getting an approximate idea of what the velocity of the stream is.

Q. What would be the velocity that you found at the various points in the Desplaines river from such investigation?

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. From three to four miles per hour. I notice that there was a channel at every point that we examined. I mean by a channel a place for navigation, deep water, deeper water; but these channels as a rule were not straight and were not entirely free from obstruction. But there was a deep water channel at every point where I examined the river; that is, a well defined channel as there is on every river except those with very sandy bars. I examined the general slope of the Desplaines river at these various points
1939 as well as I could without measurement and as well as you could tell by the appearance of the water, that is, as to the velocity with which it is traveling. Where there is greater velocity, of course, there is greater slope.

I examined the Desplaines river in reference to the general topography of the river bed and the surrounding country.

Q. You may state what is the result of your examination.

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. The banks generally show very little disposition for erosion and seem to be of fairly hard material and except at the islands they are not wide apart. That is, they are close enough together to hold the water within reasonable bounds without allowing it to spread out all over a wide river bed. They are not as high banks as I have been used to on the rivers I have been on, but they are very much more stable.

Q. When you were asked by the United States Dis-
1940 trict Attorney to make an examination of the Desplaines river, what two questions were put to you, that you were asked to pay especial attention to in that investigation?

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. The question as to whether the river is now navigable; and the question as to the possibility of making it navigable under different forms of improvement. I made all the investigation that I deemed necessary for the purpose of answering those questions.

Q. I will now ask you to answer the first of those questions.

Objected to, on the ground that no proper foundation has been laid; that it calls for the condition of the

river after it has been artificially changed, and not as it was in a state of nature; and further as incompetent, immaterial and irrelevant.

The WITNESS. As to whether the river is now navigable, I should judge from what I saw that it is navigable; that at any point I saw it that there is depth enough for fairly good navigation. Better than has existed on rivers where I have been improving previous to the construction of locks and dams. It could be clearly improved by cleaning the
1941 river.

Q. Now you may answer the second question.

Objected to, on the ground that it calls for the conclusion of the witness upon whether or not the stream in its present condition which is not in a state of nature but is affected by the works of man, may by further works of man be made navigable; and as incompetent, immaterial and irrelevant and that no proper foundation has been laid.

The WITNESS. The second question as to the improvement: The improvement can be done in three ways, one for open river navigation by removing all the obstructions, that is, the rocks and snags and projecting bars and general dredging and snagging work. That would be the cheapest method. The second is the construction of stationary dams and locks. That method is objectionable because of the overflow of adjacent land. The third is by movable dams which cause no overflow to the adjacent lands, because the dams are thrown whenever there is water enough to navigate without them. That would be the system that I would recommend, if I was recommending; locks and dams of a movable type.

Q. Mr. Thomas, in answer to your first question, you
1942 mentioned the condition as being similar to the condition on the rivers which you are familiar with. Will you please state what the condition on those rivers was before the improvements were put in?

Objected to; it does not appear that the witness has any knowledge as to the conditions before the improvements were put in; that he knew any of the rivers in a state of nature before they were affected by the works of man; and as being incompetent, immaterial and irrelevant.

Q. I will ask you in answer to the objection of counsel, as to whether you were familiar with any of these rivers prior to the improvements being put in?

The WITNESS. I took charge of the Big Sandy before any improvements had been made and looked after the snagging. There had been a little snagging done before I went there, but not much. I looked after the snagging and cleaning out all of the shoals on that river for 173 miles, and had all that done first. Then I took charge of the designing and construction of the movable dams of which we have built five, so that I know the condition of the Big Sandy over a period of nearly 28 years of its improvement and know its original condition. Know its very original condition before anything had been spent on it at all. I have testified as to the
1943 low water discharge of the Big Sandy. 48 cubic feet per second is the lowest I measured.

Cross-Examination by Mr. Scott.

The WITNESS. My first knowledge of the Big Sandy was in the year 1883. Prior to that I was engineer of the Chattaroi railroad, now the Chesapeake & Ohio. I do not hold any rank in the army. I am a civilian. I have been connected with the engineering department of the United States Government since August 1, 1883. Some work had been done on the Big Sandy river before I went upon it. That work was cleaning out the snags and rocks in the shoals and building wing dams to confine the water where it spread out
1944 over too much territory. I think they started some of that, part of it, in 1878, somewhere between 1878 and 1880. The Big Sandy proper is 26 miles, and one fork, the Levisa fork, which is also the Big Sandy, is about 120 miles, may be a little more; and the other fork, what we call Tug fork, would be 102 miles long. We call 60 miles of that 102 miles, navigable. From Louisa, Kentucky, the mouth of the river, to Williamson, West Virginia, or the mouth of Pond Creek. The character of that river above that 60 miles is rocky, and we have improved that also, but not with any system of locks and dams. That has been done by snagging and cleaning the boulders; largely cleaning the boulders. It is very rocky, very light discharge and very narrow. Boats go up the river above the 60 miles. They go 102 miles; 4[illegible] miles above. In the summer the depth above that 60 miles gets as low as 6 inches, and in winter and spring it may go as much as 30 feet; but ordinarily it will run four or

five feet; sometimes three feet. This time of the year
1945 about three feet. That is above the 60 miles. It is 120
feet wide. It is a great deal more than that on top of the banks, but on the water surface it is about 120 feet. At the top of the banks, it may be as much as 300 feet; they are very high banks. Above that 60 miles we have one shoal that is 12 feet to the mile. I should say approximately I would call it 5,000 feet; a mile practically. That is the highest slope. Generally the slopes will run in the upper 60 miles—I should say they will run from three feet—from three feet to nine feet except this twelve foot plane. At the point where it is twelve feet to the mile, the width of the river I should say is a hundred feet. The character of the bank
or channel, previous to the time we cleaned it out, was
1946 very crooked. Now it is tolerably straight; not straight,
but fairly so. This depth I mentioned usually comes—it comes with the rains, of course, and sometimes they miss out entirely; but usually they come, like this year we have had three rises in February and the chances are that they will run through February and March and skip April and come again in May. But there is no certainty about that. The lowest depth I have ever known in March, about this 60 miles which I call navigable, I should say was about a foot. The Big Sandy river has been used for the purposes of trade and commerce since about 1832. That is, I am not
that old myself, but that I know of from reading and
1947 hearing people talk. It was used by the early settlers
for the purposes of travel and to move their farm products, in the shape of batteaux or push boats and rafts, things of that kind. The steamboat navigation probably don't go back to the first settlement. But the canoe and push boat and John boat and raft navigation goes back probably to the earliest settlement. Steamboats were first used in the Big Sandy I should say about 1850, but it might be earlier than that. They went up to Pikeville. In the small fork, I don't know what they did. That is 60 miles on that fork. I am now talking of steamboat navigation on the other fork; I don't know where they went on the Tug fork. From the
mouth of the river up what I call the larger fork, steam-
1948 boats go 112 miles. This 60 miles I call navigable, goes
almost to Louisa. On that fork there is 42 miles above that that I don't call navigable. On the Tug fork you go 112 miles from the mouth, that is from the Ohio, and say 87 miles

from Louisa, the same place where these come together and make the Big Sandy. The steamers went from the mouth of the Ohio river up the Tug fork, 112 miles. From that point on the Tug fork to which the big steamers went, there is over 40 miles that goes up and then it divides again there. The character of that 40 miles is just exactly like the character of the other fork, rocky, full of shoals and narrow. The slopes are less and the depths are greater. Steamboats
1949 have gone up there. They went 20 miles to where it forks again. That is all I ever have known them to go and only an occasional trip. There was not regular navigation. Well, loaded those steamboats required something near three feet of water for the purposes of commerce, but they run on as low as 14 inches. The length of the Kentucky river is 255 miles of navigable water; open river, navigable water at the spring season. It has permanent dams. As to whether boats go over these dams, I will say, just toward the Ohio, when you get back water from the Ohio, from Frankfort down to the mouth, boats tow well over them. Captains take their boats over these dams on the Kentucky river
1950 from Frankfort down, 65 miles. The spring stage of water, before the dams were constructed, would be something like three feet and the summer stage would be down as low as six or seven inches. I should say that about what you could figure on as the period of navigation was February, March, April and May. And during these periods, with reasonable regularity they could figure on using the river for steamboat navigation, but there would be one year occasionally when they could not. They could nearly always count on a tide in the spring, though I have known it to miss. Above this portion of the Kentucky river which I say was navigable ordinarily for these months of the year by steamboats. Being asked how much of the river there was towards its source from that point at which navigation ended, I would say there is 23 miles left yet, and we have been building
1951 a dam about every four years on the rest. Within my knowledge since I have been going there, there have been six dams built. I can give it to you exactly, but it is about 80 miles of unimproved river when my first knowledge came of it, of which they have improved all but 23 miles since. The improvement of the river now goes from the mouth of the river 216 miles. Above that 216 miles it is rocky, a great many bars in it; with the exception of high banks it is a good

deal like the Desplaines, only it is not so wide and it has got very much higher banks. The slopes in that upper river will run 15 inches to the mile on the average, but there will be certain miles in there that will have as much as three feet. The depths will be about three feet, running from that down to a great deal less for an average of three months,
1952 February, March and April. Sometimes April will be left out and it will go over to May. That is a frequent occurrence. The narrowest point on the river above the 216 miles is now about 200 feet. The discharge of the Kentucky river above the 216-mile point ordinarily will be 300 cubic feet a second, there being extremes that will run it down to a hundred. Above these 216 miles gasoline boats navigate the river for fully 255 miles, now and then in the spring season. There is no regularity about that navigation. You cannot count on it. Those boats carry freight up there, they carry all the whisky out of there; that is the principal thing that is made there. The draught of those gasoline
1953 boats runs from 14 inches to 36 inches. There are no boats regularly engaged in carrying on trade on that upper river of that character. Not above the slack water. They can at times go up there, however, and do. It will happen every spring; maybe there will be one spring in four that it won't happen, but I should say that that is a general condition that will usually happen in the spring. The Guyandotte river in West Virginia is a river that is capable of being used for purposes of useful navigation that was not at any time used for such purposes. It is only used for rafting. The character of the country through which Guyandotte runs is fairly good bottom farm country for a mountain country, but the chief business has been getting the timber to market, cutting sawlogs and now the mining of coal.
1954 The Chesapeake & Ohio railroad comes in there and mines coal in that country. It is not a thickly populated country. There are not many towns along that river. There is not much farming product there. They consume more farming product than they raise; it is imported. There is 80 miles of that river that might be called a navigable stream, as you call the Tug at any time a navigable stream. Its slopes are from one to three feet per mile with alternate pools and shoals here and there. There will be as high as three or four feet to the mile for a short distance at these shoals. They are exactly like I have described for the Tug

and for the Kentucky, except it is not as wide of course; that is as wide as the Tug. I mean the upper part of the Kentucky. The Guyandotte empties into the Ohio at
1955 Huntington, West Virginia, 160 miles above Cincinnati. Huntington has thirty thousand population. From 1880 to about 1892 boating on this river was carried on by small sidewheel freight carriers, or packets that you see through all that country, carrying about sixty tons of freight. The Guyandotte was used for a period, but the railroad going in there carried the freight and they could not live. Prior to
1880 the Guyandotte was used by push boats. They carry about eight tons and are poled by men.
1956 Excluding the Guyandotte, I do not recall any river which in the times when the railroads were not as nunumerous as they are now, was capable of being used for useful purposes of commerce that was not used for such purposes.

Q. Isn't it true that as a rule in the early settlement of the country wherever a stream was capable of being used by the settlers bringing themselves and their families in and their products out, that the streams were so used, if navigable?

The WITNESS. I could not say as to that.

COUNSEL FOR GOVERNMENT. Objected to as plainly not cross-examination, and I move to strike out the answer to that question.

Q. Wouldn't it seem reasonable to you?

Objected to; that is plainly not cross-examination.
1957 (No response.)

The WITNESS. The Muskingum river enters the Ohio at Marietta and it runs through the State of Ohio for 91 miles of navigable water to Dresden, Ohio, the end of the canal. It connects with the canal system that goes on to Lake Erie, forms a part of it. The navigable period of the year on that river is the year around there; it is all slack water. I was only familiar with the upper ten miles of it before it was slack water. There was a little navigation carried on between the canal and the slack water portion in there before we built the dam that connects the two
1958 now. I have known that ten miles since about say 1890; from 1890 until the present day; we commenced building our lock there in 1908. That ten miles had very high depths, as much as four feet sometimes; but ordinarily not

over two and a half. Those depths, the two and a half, might be called the year around. The four feet would exist say six months. Those six months would be from about the first of January up until the first of July. The width of that river for those ten miles is something like 400 feet. The slopes are very light. I should say not over seven or eight inches to the mile. I was not familiar with the general character of the river below the ten miles and from there on to its mouth. The State of Ohio built those locks years ago be-
1959 fore the Government took charge of the river. As to the other 81 miles of the Muskingum as to its natural characteristics, I should say it was hardly capable of continuous navigation without the slack water. Possibly six months in the year it was capable of navigation without the slack water. The stages of water below those ten miles, in the other 81 miles, would be greater because there are other tributaries that come in. Below the ten miles, that is the 81 miles from the mouth up, I should think they would be from four feet up for six months in the year. The slope of the Muskingum is gentle all the way through. The widths run as high
1960 as 800 feet, but they got down to about 300 feet; in one or two points the river is choked in. The character of the channel is rather crooked. I don't know how early the Muskingum river was used for purposes of navigation. Those locks have been built more than fifty years I should say. I could not say that prior to the locks having been built that there was steamboat navigation on the Muskingum river. I should think there was no steamboat navigation on the Muskingum river before the locks and dams were built, but I don't know, because the State of Ohio took that up very early and built those very early. The lowest discharge of the
1961 Big Sandy was 48 cubic feet per second that I had observed. That was at Louisa, Kentucky; that is just below the junction of the two branches. In the year 1897 I measured it. I made a number of measurements that year. That point is 26 miles from the mouth. As to what month of the year it was, I will say in August, September, October and November, and during that time, I should say October would be the month of low water or possibly in November. That was the extreme low water that has ever been observed. I have taken hundreds of measurements and that is the lowest. The Muskingum was 400 feet per second. That is extremely low; the Muskingum has a good discharge, generally as good as the Ohio. It generally discharges I should say 1200 cubic

feet per second. That discharge of 400 second feet might occur for a short period in almost every season, but it only lasts for a month or something like that. It is the low-
1962 est that I have observed. I could not say when it was made. That is given as the discharge of the river. As extreme low water in our reports, that is the record of extreme low water, as far as we have observed, as far as has been observed by the assistant in charge. The normal stages of the Muskingum are well prolonged. The character of the country is rather flat and the rainfall don't run off like it does in these mountain countries I have been telling you about; it is held in the fields and woods and goes off more gradually. There is a retention of it, and then the soil is not sandy, and it does not lick it up like these sandy soils in the south. It was on the 28th of December that we inspected the Des-
1963 plaines river. There was snow on the ground. It was melting. It was a cloudy day, disagreeable only under foot. Beautiful outside. It was not muddy; it was frozen.

We left Chicago about noon, arriving at Joliet. I should say, at one o'clock or something after. We were met there with automobiles. I couldn't say how much time we spent inspecting the river at Joliet. We crossed the several bridges and stopped on each bridge or at each end of each bridge possibly, I don't remember; and did a good deal of talking and observation of current. I don't know how long we were in Joliet. I couldn't say what time in the afternoon we left Joliet. I was not paying any attention to the time. I should say we got to Joliet about one o'clock. I don't remember what time we left Chicago. I know we ate dinner on
1964 the train, so it was about noon when we left here. I think probably we went down on the Alton, but I wouldn't say. From Joliet we went by automobile and followed the road. The road for some distance departs from the river. After leaving Joliet we went to a place called Brandon's bridge and the island, Treats' Island, I believe, is the name of it; we had to get off and walk to these places.

Without looking at the map of course I can't say where Treat's Island is with reference to Brandon's bridge, but my recollection is that it was one island—I think maybe we went to see two or three, but I think there was one island just above a bridge, I believe that is Brandon's or Smith's, but I would not say; I cannot locate these things exactly where they are. As to whether or not I am clear whether Treat's Island is above or below Brandon's bridge, I will say there

is one above and one below; I don't know which it is. We had to walk through the fields to get to them. I could not say that we took any observations of the river between
1965 McDonough street and Brandon's bridge, McDonough street in Joliet. We returned to the river at many places after leaving Joliet. I couldn't say what they were. We came to some bridge, I don't know whether it was Brandon's bridge or not. I believe it was, however. Then we got off and walked up stream. I calculate we walked a quarter of a mile. We crossed one fork of the river and went over onto this island to another bridge, and then we got out and went up to a field—or rather we took our autos into the field and walked back. That is Brandon's, I think. There was only one place where we got out and walked upstream. The
1966 next place we walked straight out into the field. I should think if we walked up stream it was at Treat's Island. As to whether, if Treat's Island is some miles below Brandon's bridge, did we not get out between McDonough street and Brandon's bridge, I couldn't tell. As to whether it is true that from the time we left the last bridge that we crossed in Joliet until we stopped at Brandon's bridge, we made no inspection of the river at any point, I could not testify to that, I am not clear. As to whether I know what the character of the river is between Brandon's bridge and the bridge at McDonough street, the last bridge we crossed in Joliet, I will say I think we drove out onto a place between these places, come to think of it, and we assumed there were three feet of water underneath it, whatever that was; but I don't know what it was called. That was below Joliet. It don't seem to me it was more than two miles below Joliet, but just what place it was I don't know. I can't carry these things in my mind. We got of the machine a third time, but I think we didn't walk any distance. All of us got out. I should say that was on the west side of the river. It is the side
1967 we were going down from Joliet. It seems to me we went off on a side road into a field, but I am not positive of that, some distance below Joliet. I am a little hazy about it, but I should say about two miles below Joliet, it might have been three, but I don't know. But we did go to a place and observe the water; what it was I don't know. I did not measure the slopes at the place where we observed the water between Brandon's bridge and McDonough street. We had both cross sections and maps and examined them every time we stopped. If we stopped at a given point we would examine

the cross section as near to that point as possible. As to whether I examined any cross section between Brandon's road and McDonough street, I will say I don't remember. I do not know what the highest slopes on the river are between Joliet and the mouth. All the knowledge I have of slopes
1968 on that river is not gained simply by looking at the stream. I have had the map and have it yet. I have the profile. We got back to Joliet just a little after dark, I should say maybe an hour after dark. And dark on the twenty-eighth of December came I expect about five o'clock. I do not know how long it took us to get from the mouth of the river back to Joliet. It was pretty well toward dark when we started from the last stop we made. The last stop we made was at the Economy Light and Power Company gravel pile, that is where they are working; where they had put a cofferdam in the river. I don't know what time we left there. I should think though that we left there something near five o'clock, but it might have been earlier yet, I don't know; it was nearly dark. It was not very long until dark after that, but how long after that I don't know. Being asked, where did you take that float measurement, at what point, I will say
1969 there were two. One I think at a bridge, whether it was this bridge or Brandon's bridge or some other bridge, I don't know; it was above that bridge and I think at the lower end of an island, and the other one, as I should think, below the next bridge, if there is a next bridge down there. As I say, I am hazy on that. We took two measurements—two that I remember of. One at a bridge near the lower end of an island and the other I am not positive there—we drove through a field to get to it. The place we drove through a field to get it was not at the aqueduct; this was above the aqueduct, I think maybe the next stop above the aqueduct. I should say that it was approximately 300 feet between the point where I made my calculations. At the upper one. At the lower one it was probably less. As to who measured the 300 feet I will say it was approximated by pacing and also by timing. That last one was made by timing, too, whether it was going as fast as a man would walk. That upper
1970 one was different, but this lower one was simply a very approximate approximation. As to where the float was put in the river,—the center or towards the shore, I will say as far out as a man could throw, a good strong man like this engineer of the Sanitary District was who threw it. I should think it did not get to the center. It was pretty far out; he

had a strong arm. He did not throw a chip; it was a club, something that would go. As to whether one man walked down three hundred paces and stood with a watch and the other one up above timing with a watch, I will say, he didn't; he walked down alongside of the float at that lower place. At the upper place I did some walking myself. At the lower one I did not do it. As far as I know they didn't have a stop watch. That would not be the method we use for anything but an approximation. Mr. Cressy took us to the river;
1971 he had charge of the river. As far as I know there wasn't any special selection of the place. I was in the automobile and I followed the crowd. As to the velocity as determined by two measurements such as I have described at two points picked out on no particular principle of selection, I would say that it would not be of much value in determining generally the velocity of the river. I would not rely on it if I wanted the slopes with any accuracy. If that was the only thing a man had to depend on to determine the adaptability of the river for navigation I would not place much reliability on it. I also depended upon my familiarity with deep places in rivers. At Joliet I saw what seemed to me to be at least places as deep as anywhere else; that is what it ap-
1972 peared to be on the surface below that dam. For a good long ways below the dam there seemed to be the deep water, except of course at the plant of the power company there is a fall there; and that cofferdam going out there, there is a fall there that is now equal to a dam in the river, or was when we were there. It is not navigable at that point as it is now, I should judge because of that cofferdam. As to whether I know the condition of that river before that cofferdam was put in there, I will say I know the condition of water that we have cofferdams in, and we have that same effect wherever we build them. If the cofferdams were out of there, knowing what the effect would be on other rivers,—and probably it would be the same there; that is the river probably would assume normal conditions. Being asked to assume that in the building of that coffer dam or before its building, the river was widened and deepened by blasting away 100 feet of the bank on the opposite side, and that the cross-section is as large now as it were before the cofferdam was built, would I still say the rapids there were due to the cofferdam, I would say if you have the same area as you had before, you
1973 would have the same slope as before. Being asked whether I have knowledge as to what the physical con-

ditions there were before the Economy Light & Power Company began its operations, I will say that I never saw it before. In its present condition, at that stage of water, it would not be navigable. At that stage of water I should say the slope was 25 feet a mile for a very short distance. That would not be navigable.

As to what would be the extreme limit of slope where you could navigate, I should say that for a short distance I have known navigation to go on where the slope is according to reports, 15.2 feet to the mile for a distance of eight hundred feet. If it got above that, you couldn't navigate without putting out a line and that would be cordelling.

Q. You cannot cordell in a river which has widths of 40 feet with a crooked stream at the point where that narrow width is, can you, with a slope of 15 feet to the mile at the same point?

1974 Objected to, on the ground that it is a hypothetical question based on conditions which the evidence has not shown and cannot show to exist in the Desplaines river, either in its present condition or in a state of nature.

DEFENDANTS' COUNSEL. The fact being that it was shown on the trial of the state case that the narrowest place was near Joliet, where on one side of an outlet which was subsequently excavated by the Sanitary District there was 60 feet, and 40 feet on the other. Now, read the question.

(Question read.)

The WITNESS. Well, that question can not be answered without you know the form of your boat. There are boats that do cordell chutes as narrow as that and that are crooked, on depths from 14 inches to three feet, but they are very poor boats. Boats are cordelled on that kind of a slope on a

1975 river that wide and crooked at Letart, Ohio. I don't know the width of the river at that point.

Being asked as to whether I know that is the point where cordelling was done under the conditions which I have described, I will say, as to the 15 feet fall, I cannot answer of my own knowledge. I can as to the 40 feet in width and about the crooked chute and to a fall of say—well, I haven't the fall of the points testified about. I haven't got the fall of these places where it is narrow. That 40 feet of width where they have cordelled is both on the Upper Big Sandy, and on

1976 the Upper Tug Fork. The width has been as narrow as 40 feet where they went through. Not a straight channel by any means. I know of their cordelling there. I was

right on the boat when they did it—a little steamboat, a 60 foot boat; but that has been 15 years ago. As to how long a distance was that cordelling, I should say there was 800 feet. There are three miles of free navigation above and say a mile and half below the point where this cordelling was done to the next shoal each way. There was 100 miles of navigable stream above it and about 35 miles below it. I should think that 40 feet is the width through the shoal. The river usually is 150 to 200 feet wide, but in the shoals we build rock walls to confine the water during the summer season and sometimes we do not build over 40 feet apart, loose rock, bowlder walls
1977 so as to keep the water from spreading at that point. Referring to this 40 foot wide channel, the banks were walled so as to confine the water flow walls, and the stream above was, I suppose, 150 feet wide. The depths of the water in the stream above would vary in the pools; about three feet, I expect, in this confined part where we built those walls to confine the water. We tried to get three feet in there; we couldn't always do it, but we tried to do it. Sometimes it would go as low as 14 inches. At the time we were then cordelling, I should say there was somewhere in the neighborhood of two and a half to three feet of water. The character of the bottom was rock, heavy gravel, bowlders, heavy bowlders; those shoals all have bowlders. That point is at Greasy Shoal on the Big Sandy river; there are a half dozen just like it. The bowlders had been cleaned out; they had been
1978 taken out from the side to make these walls. At the time we cordelled the character of the bottom was just the water; it was a clean bottom but still rock bowlders under that, and the sides were bowlders; there was the danger in the thing, of course, of throwing your wheel onto those rock walls. The current was probably six or eight miles an hour; six miles an hour anyway, and probably eight. It was very swift. I could not say what was the slope per mile.

Q. Increase that current to ten miles an hour and try to take your boat through such a place as you have described; what would be the probable effect?

Objected to, on the ground of its being a hypothetical question, based on facts which the evidence does not show and can not show to exist, namely a current of ten miles an hour.

COUNSEL FOR DEFENDANT. In answer to which I state that it was shown in the state case in evidence which is stipulated to be evidence in this case.

COUNSEL FOR GOVERNMENT. Whereabouts?

COUNSEL FOR DEFENDANT. Woermann gave the slopes. It is there. Go ahead.

The WITNESS. I don't know.

Being asked, suppose you had a fall of 21 feet in
1979 three and a half miles with a maximum slope of more than ten feet per mile, and a curved channel, a series of abrupt curves and channels, what would you think with a boat under such conditions as that on 15 inches of water, I would say, I don't know. As to my opinion, if it would be possible to take a boat up under such condition as that, up stream, I should say it would depend on the character of the boat. As to whether a steamboat would go up there I will say it would have to be very light draft, if it went on 15 inches. I do not think it would go up a slope of that nature without cordelling.

Being asked to assume that the bottom was full of bowlders; what do I think about the possibility of taking a boat up under such condition, I would say I don't make any claim to being a steamboat man at all; I am an engineer and I can only give you the other case because I happened to be on the boat and observed it.

As to my having testified as to its being a navigable river and what would be the effect of having a bottom under such a condition as I have suggested, the 40 foot channel, with the depth that I named and the walled sides, if the bottom was
still full of those bowlders would it be possible to go
1980 through that channel or to cordell a boat through it, I would say, if you had water enough over your bowlders you could go through. You would need whatever the boat drew and then some; how much I don't know. I don't know now how much the boat I was on drew. I should say when she was light she drew about 14 inches, and when she was loaded she drew three feet. I don't remember the condition of the load then.

Being asked whether when she was light would she be very useful in commerce, I should say, not unless she was going for something. As to whether we have to take the condition as well when she is going back with her load, I would say yes, unless you wait for water. You would have to have enough water over the bowlders to allow for her draft and then some. If you didn't have the depth the boat drew through the channel she was passing over, of course she would not go.

Q. If the condition of the channel in the Desplaines river were such that canoe could not pass down it unless in the

hands of a very experienced man who knew the bowlders in the river, could not pass down it without constant watch-
1981 fulness to dodge bowlders, the condition of the river being such as to bowlders that that watchfulness was necessary, do you think that in that condition, without a clearing off of the bowlders, such a river could be used for useful purposes of commerce?

Objected to, on the ground that the hypothetical question is based on facts which are not shown to exist and cannot be shown to exist.

COUNSEL FOR DEFENDANT. It will be shown by the testimony of the witness introduced by the State on the State trial and stipulated into this case. Now, you may answer.

COUNSEL FOR GOVERNMENT. What was the name of the witness, please?

COUNSEL FOR DEFENDANT. Clement.—Now proceed.

The WITNESS. I should say for purposes of commerce the same caution would have to be exercised by the man who takes the boat as is by the man who takes the canoe, and then he wouldn't go through, that is all.

Q. Now, let us get at the exact amount of your knowl-
1982 edge of the Desplaines river upon which you base your proposition that it is navigable.

COUNSEL FOR GOVERNMENT. In order to anticipate your question I will say that we shall prove by a competent witness who is familiar with the places the exact point at which we inspected the river on that day with Mr. Thomas.

(Question continued.) What do you know as to the depths of the Desplaines river on the day you saw it, taking its course from Joliet down to the mouth?

The WITNESS. Only such as I learned from the profiles and cross-sections shown me by the Sanitary Engineer, Mr. Heilbron. Mr. Cooley was with us there too, but Mr. Heilborn had the map. As to what I learned from that without the lowest depths, I would say at the points we looked at, my recollection is, there was three feet of water.

As to whether I was told those were the lowest depths in the river, I would say the cross-sections showed what they were and my recollection is that it was a depth of three
1983 feet. They just simply showed me the cross-sections at the points we looked. That is my recollection of it now, that there was three feet as being the lowest depth—there was a depth of three feet at the points we looked at; that is my recollection.

Being asked as to my understanding that those were the lowest depths in the river, I would say, at the points we looked at it was, but I don't understand as between those depths what the depths were at all; I don't think I looked at the cross-sections between those points.

Being asked as to whether I am assuming that there were no lower depths than the three feet, in giving my conclusion here, I would say, I am assuming that if there were lower depths than they were at points where there was not so much velocity as there was at the points we looked at. The basis for that assumption is where the river spreads out ordinarily there is not so much water, and a great deal less velocity.

Being asked, what basis I have for assuming that at points other than those I looked at, where there was, if there was a lower depth, that there was less velocity, I would say I haven't any ground for the assumption at all. I got the impres-
1984 sion that there were lower depths in places where there was less velocity. Where those places were, I don't know. As to how low depths I had in mind when I testified that the Desplaines river was then navigable, I thought they might be as low as two feet; I looked upon the profiles, but I don't know whether I got that idea from the profiles. These depths that I speak of are clear of or over the bowlders; they are the depths that are shown—of course, there are bowlders sticking out of the river.

Being asked if the profile in giving the depths does not take account of the bowlders, I would say, if it crosses one it ought to show it. If the bowlder were sticking out of the river there would be no depth over that at all. I would not navigate that. If the bowlder were only six inches under water you would see the break in the water.

Being asked as to my assumption that this depth of
1985 two feet I am speaking of was above bowlders, I would say, that was only an assumption and I don't think I gained it by looking at the profile, but probably from somebody telling me. I can only speak of the places where I was, and what it was between those places I don't know anything about and don't pretend to know. My testimony is based upon the conditions existing at the points I saw, and there the lowest depth I saw was three feet. Those were supposed to be the points where there was the greatest velocity; that was my idea exactly. It was the velocity I was looking at more than the depth, that was three feet of navigation, of navigable water.

Being asked, if it should turn out that in those places there were pieces of bowlders extending through the channel of the stream and that this three feet was not above those bowlders, then my conclusions would not have the same value, as to its being navigable in the condition in which I saw it and without improvement, I would say, at the points where I saw it there was nothing in the way. That is, I couldn't see
1986 any bowlders sticking above the water. Nor you couldn't see their break. You see, where there is a bowlder the water shows it to a considerable depth. I should say where you have a channel of three feet, if there was anything showing up in that to amount to anything at all in the way of a bowlder, it would appear on the surface; there would be a break.

As to whether my assumption then is that at these points where I saw the river where there was three feet of depth, that the bed did not contain bowlders and I determined that by the appearance of the surface of the stream: I would say, I saw bowlders, but at the point I saw them I figured that a boat would go between them without any trouble on that depth of water and velocity.

Q. You have not answered the question I asked you. You testified that the surface of the water would indicate whether there were any bowlders below. Now, is it true that you assumed that at these points where you saw the water and got the conclusion that there were three feet of water, that
1987 you saw no indication that there were bowlders under that water at these points where you have your three feet?

The WITNESS. The whole bed may have been of bowlders as far as I know; I don't know what the beds are. It may be sand and it may be bowlders, but I take it there is three feet of clear water above the bowlders there. Above the bowlders or obstruction of any kind. There are bowlders sticking up, but you can go between them. I saw them. Those sticking up you can go in between. As to what knowledge I have of those underneath and not sticking up, I will say I haven't any knowledge at all; I didn't go into that.

As to how I get at that three feet, I would say, from the profile or stage of water, and from the general appearance. Of course it was only the appearance; I didn't measure any depths. Where I took those points and I was told there was considerable velocity, the surface of the stream was rough

and turbulent. It has the appearance like swift water always does, it is raised slightly, wavey.

As to whether that swift and turbulent water did not
1988 indicate that it was running over a rough and uneven bed, I would say, well, to a certain extent, yes, yet a sand bed will do the same thing, a bed of sand will have the same effect, as well as bowlders, when the velocity is not enough to move the sand. Take the Big Sandy,—they all have high velocity down stream, but the sand is not moved off, and it has the appearance of bowlders in the stream. It is not, however; you can go in there and pick it out with your hands. As to when you see these indications in the river I have talked about, you can not tell whether it is bowlders or sand that makes it, if you have a very swift current you may know it is not sand because the sand will leave there; but if it is not so swift it may be a sand bar.

Being asked, if I know at these points I saw whether it was a sand bar or rock, I will say, I did not see any sand bar except on the island. Everything I saw down there was rock. The channel on the island that I observed was the left going down; that is the left bank of a river; east. I do not
1989 know what the slope was on that east side of the island.

I have not kept any of those in my mind. I did not make any memorandum at that time. As to whether I formed this judgment simply from the impression received without making any notations of the conditions, I will say, at the time I knew what they said the fall was at that point, but I haven't kept it in my head since. As to what they did say the fall was at that point, I will say, I knew at that time, I don't know now. As to the width of the stream at the head of Treat's Island, on the left hand side of the channel, I would have to guess at that. Right at the Island I should say it was something like 150 feet, but I would not say for certain. At the bridge the abutments have run in a good deal more and narrowed it down. The depth of water required to carry on useful commerce over a bowlder bed in a stream of the slopes of the Desplaines river as I observed it would depend en-
1990 tirely on what kind of navigation you want to carry on.

You can carry on the most useful navigation, some that I have seen, on ten or twelve inches on a stream of that sort —on a small stream, with a bowlder bed and having the slopes of the Desplaines river.

As to the maximum of the slopes between Joliet and the mouth, my recollection is that up there near the dam it is

something near 15 feet to the mile, but I don't know that that is so. I looked over the profiles and figured it out from that, but that is my recollection of it.

Q. Assuming a bowlder bed clear across that stretch of 15 feet to the mile, on how many inches of water would you carry on profitable navigation of any sort in commerce.

Objected to, on the ground it is not shown there was a bowlder bed in that stretch of the stream.

The WITNESS. Well, I have answered the question; it depends entirely on the character of navigation.

Q. Any navigation for useful purposes of commerce with slopes of 15 feet to the mile and a bowlder bed?

The WITNESS. Then you will have to qualify that by saying how long, over how great a distance this 15 feet per mile should be. If you go gradually over it I have seen navi-
1991 gation, push boat navigation that I was used to for years, go on seven or eight inches of water.

Q. You have also seen boats pushed across the land, haven't you?

A. No, sir.

Q. And up through beds of streams?

A. No, sir, I have not.

Mr. SCOTT. Your experience is not as great as some of the witnesses.

Mr. CRESSY. We object to the impertinent remark of counsel and move that the remark of counsel shall be stricken from the record.

Mr. SCOTT. Mr. Cressy, I think that is absolutely unreasonable.

Mr. CRESSY. Let the record show that.

Mr. SCOTT. Yes, let the record show that. I can put it only to youth and inexperience that you should have made such a remark as that. The record can show that, too.

Mr. CRESSY. Very well.

Mr. SCOTT. I regret very much that you should have found it necessary in an examination that has gone as pleasantly as this has, to make such a remark as you have made.

Mr. CRESSY. I simply desire that the record shall show that the remarks of the counsel in reference to the testimony of witnesses is entirely incompetent.

1992 Mr. SCOTT. I suggest that if they are impertinent, which is the language he used, it does not require any language from counsel to prove it. The remarks are in the

record and therefore the record will show, without his conclusions, whether the question was impertinent or not.

The WITNESS. Being asked as to whether I have stated, that this was lower than the ordinary stage, and the reason I have given, I would say, the lack of vegetation over a space between that water and where the vegetation commences, showing that the water had stood there and killed just as it does on slack water exactly, had killed vegetation. I did not make any investigation to ascertain whether there were any unusual causes for a difference in the appearance of the river bank in that particular from what would be the case in a stream where the operations of nature had not been interfered with by man, I made no investigation to ascertain whether or not the stages of that river, or the elevation of the river, was controlled or affected daily by the operation of the dams and water power above.

Q. Did you know that the elevation of that river varies 100 feet in a day because of the operation of the power plants above?

1993 Objected to.

The WITNESS. I don't know it.

Q. If those facts were true, then the only observation upon which you base your opinion as to its being a low water stage, would not be a fair basis for any such conclusion, would it?

The WITNESS. Well, I want to qualify that by adding another, if you will let me.

Q. That is the only one you gave; let us take that one and then you may answer the question.

Mr. CRESSY. The witness may qualify it in reference to the answer to this particular question, if he desires.

Mr. SCOTT. I shall insist that the witness shall answer only that particular question asked. If he wishes to give other reasons afterwards, of course he is at liberty to do so.

Mr. CRESSY. He may qualify his answer as to this particular question if he desires.

Mr. SCOTT. Mr. Witness, the United States Attorney has so instructed you. The law is that it is your duty to answer the question asked you and not some other question. Will you read the question, please?

(Question read.)

The WITNESS. You did not go far enough; "those facts." I don't know what those facts were.

1994 Q. The only fact that you refer to was what you observed upon the bank.

The WITNESS. Pardon me, that is not what I am driving at. You make a statement that there were certain fluctuations—

Q. I say, go back far enough to include the fact that by the operation of the power plant above on that river the discharge of water varies 100 feet in a day and is constantly varying.

Mr. CRESSY. Now, read that question, please.

Mr. SCOTT. Unless the witness says he does not understand it, I would like him to answer it as it stands.

Mr. CRESSY. In order to make my objection I would like to have the full question in the record, and I would like to have the witness know what he is answering.

Mr. SCOTT. I have not heard the witness say that the full question is not in the record, or that he does not understand the question.

Mr. CRESSY. I ask that counsel for the defendant restate the question so as to show just what is meant by the question, for the purpose of enabling the government to determine as to whether it desires to make an objection to the question.

Mr. SCOTT. The record is now made; if you can answer the question, do so.

The WITNESS. If this fluctuation would keep the water
1995 up long enough to kill the vegetation that shows there, then I should say that I had based wrongly; otherwise I should say my basis was correct. And in addition to that I want to say—

Mr. SCOTT. Now, let me say—

Mr. CRESSY. Let the witness finish his answer.

Mr. SCOTT. Just allow me, Mr. Cressy: in addition to that I now desire that you shall go on and make the qualification which you suggested you desired to make some time ago.

The WITNESS. On the remains of the aqueduct which I saw down there are stains; these stains to all men familiar with water, are from a stage of water which stands like on your bath tub when you go to bathe, around the top of the water is the streak of the stuff that is coming off you. The stage the day I was there was, I should say, some eighteen inches to two feet lower than this black mark, or dark mark on these remains. I forgot to say that when I told you about the grass, but that is a fact also. Those two things led me to believe that the water was lower than it ordinarily stood. The vegetation was killed at a certain level throughout the river, just like it is on a slack water river; and the aqueduct remains show these stains, and this water was below those stains, and

I called the attention of some of the engineers to that fact. I said that was a thing I observed right there, that there was a constant stage, or something nearly constant that darkened those remains at a higher level than it was then.
1996 That is the only thing I wanted to say; I wanted to bring it in to fortify the other. How far that aqueduct is from the mouth of the Desplaines and of the Kankakee river I don't know. I would think it was a mile or so. As to what extent the elevation shown upon that aqueduct is influenced by the back water of the Kankakee river, or bears relation to the normal stage of the water of the Desplaines at points higher up the river, I would say the back water of the Kankakee river the day I was there would not have reached this mark I am telling you about. I know by the fall over the cofferdam. The fall over the cofferdam was at least two feet.

As to whether I assume to pass judgment as to what the back water of the Kankakee river is by what I saw in the short time I was there on that day, I will say I would as to two feet, because there was a break of two feet at the cofferdam. The back water has got to cover that before it can hit this mark; it has got to rise over this two feet and drown that two feet out before it can reach this mark on the aqueduct above. I do not know how many feet the Kankakee river rises. As to whether I might be mistaken, I would say,
1997 I cannot be mistaken as to the two feet below that day. I mean it would have to rise more than two feet in order to touch this bridge, because it was a break, and it would have to rise over that. If it raises ten feet more it will go eight feet over this mark I saw at this bridge, but it won't make a black mark at two feet.

Q. Suppose that by reason of the back water in the Kankakee the water at that point in the river stays at an elevation of three or four feet, due to that back water, it would make just such a mark on that aqueduct, wouldn't it, as you saw, for several weeks at a time?

The question is objected to on the ground that it is a hypothetical question and there is no foundation for the assumption of the facts put by counsel, because that condition cannot exist at the point in question.

COUNSEL FOR DEFENDANT. Of course I have not omniscence of the counsel for the United States, who, ex cathedra, states that things can and cannot exist. I am assured, however, that

that is a proper question to ask; and in answer to the
1998 objection which counsel has so frequently made that nothing appears in the record upon which the hypothesis is based, I am unable to understand why counsel so frequently makes an objection when in the ordinary conduct of a lawsuit it is impossible that the defense can put in its case and therefore lay the foundation for its hypothetical questions until the plaintiff is through with its case.

Mr. CRESSY. If the hypothetical question is to have any value in defense, it cannot be based upon a fact that has not been proved, but a fact that will be proved.

Mr. SCOTT. Whether this will be proved does not depend upon the statement of counsel for the United States as to whether it will or will not.

Mr. CRESSY. I desire to preserve my objection; if subsequently counsel for the defendant shall show that the Kankakee produces back water to the extent as given in counsel's question, I withdraw my objection, but until then my objection stands.

Mr. SCOTT. Read the question.

(Question read.)

1999 The WITNESS. Yes, sir. Being asked if I have also studied the general topography of the banks of this river, I will say, I did not study the banks; I looked at them and formed my opinion that they were good banks, that was all.

As to the topography I would not undertake, from my observation of it to say, I will say only that there were a good many low bottoms, and I observed those very particularly as I always do when I am examining a river.

As to the fall in the river at Treat's Island on the left hand channel, I have no figures in my mind at all. I depended entirely on the map. As to what was the highest fall that I heard of when I was getting the information to enable me to form this opinion as to the navigability of the river, I depended entirely on the profiles given me and made up my judgment on those profiles. Then I dropped the matter from my mind and it has not been in it again until today.

Being asked as to whether I am now able to state the factors upon which I give the conclusion that the stream is navigable in the condition I saw it that day, I would say I feel like I have stated them.

Being asked to give the slopes on the left hand channel go-

ing down the river at Treat's Island, I will say I cannot
2000 give you any slopes at all. As to whether in order to determine the question of navigability, it is necessary to know the slopes, I will say, yes.

As to how then, have I given the factors entering into the question of navigability, if I cannot tell the slopes, I will say I looked up those factors and determined then on the 28th day of December, and am now testifying to what I observed on the 28th day of December, and I have not kept any of the details of that in my mind. I formed my own judgment of the fall at the mouth of the river; that there was something like a two-foot fall there. I should say two feet in about 200. I figured that it was at the rate of 50 feet per mile; that would be something like two feet in two hundred. I do not know what the fall is on the right hand channel of Treat's Island.

Q. Have you any impression as to what it was?

2001 Mr. CRESSY. Objected to as not cross-examination.

A. No, sir.

Q. Would it make any difference to you, in your judgment, what it was?

A. The right hand bank?

Q. Yes.

Mr. CRESSY. Objected to as not proper cross-examination.

A. I figured the left hand for navigation if it was used.

Being asked, would it make any difference what the fall was in the left hand channel, I would say, why, of course, the greater the fall the greater the velocity, and there could come a point where you could not navigate it if the velocity was great enough. Where that point would come depends again on the question of navigation. If you are going to cordell you can navigate on a greater velocity than you can if you do not.

As to what kind of navigation I was speaking of when I
2002 answered the question of the United States as to the navigability of this river, I will say I believe you could navigate without cordelling at all the points we looked at, except Joliet; as to Treat's Island, I believe you can go up that without cordelling at all.

As to what slopes could you go up without cordelling at a place, the characteristics of which are such as Treat's Island on the left channel, I will say I can only form a judgment by what I saw there. The current there is not very swift. That is not as swift as it is above, and I believe that boats do now and can navigate a place like that with their natural power without any rope.

Q. You have not answered the question at all. The question was what slope could they navigate at. What do you assume to be the slope when you say it could be navigated?

The WITNESS Oh, say, from six to—Well, say eight feet to the mile.

Q. Suppose the slope on the main channel near the head of the Island is 17 feet to the mile, and at the foot it is 18 feet to the mile, is it still your opinion that you can go up there without cordelling?

The WITNESS. The distance would have to be very short if you did.

2003 Q. You mean that the distance where those slopes prevail would have to be very short?

The WITNESS. Those velocities, yes, sir. I do not know any pdace where those slopes are navigated 17 or 18 feet per mile, not without cordelling for any distance. I don't believe that they could be navigated without cordelling under ordinary conditions. I mean by ordinary conditions you would have to have a very powerful boat and a very straight channel and good depth. At that point you haven't a straight channel, at Treat's Island. There is a bend there.

Q. Both at the foot and the head of the Island?

The WITNESS I remember the foot.

When I am speaking of the depth, I would say the depth you would have to have would depend on the kind of boats you had. Those small boats I have in mind for navigation of

2004 this character, without the expenditure of money for the improvement, draw about 14 inches, and they would want as much as 18 or 20 inches to run on, and more, if they could get it. Those boats carry very light loads, not over sixty tons. They draw from fourteen inches with a small load to thirty inches with a good load.

Being asked, how wide did I say I assume the river to be at that point, I would say, just guessing at it, it was in the neighborhood of 150 feet.

Q. Assuming that at that island the bottom is covered with numerous bowlders, various sizes, across the entire bottom, in order to navigate that stream under the conditions named, what depth of water would you have to have over the bowlders?

Objected to.

The WITNESS. For a small boat you would need eighteen inches, I should say, and for larger boats a great deal more. That is over the bowlders. I saw some bowlders sticking

through above the water. They varied a great deal.
2005 None of them very high, but I should say I saw several there, I remember, it was from one place we stopped—that was sticking out about a couple of feet.

Being asked whether they were sticking out about a couple of feet and that in about three feet of water, I would say, they were not right in that, but they were in the same neighborhood. There were no high bowlders with moss on them; they were all clean that I saw.

Assuming that at the mouth of the river there was a slope of 20 feet to the mile, for 400 feet, and being asked if that would be navigable, I will say possibly it would if it was
2006 equally distributed over the 400 feet. What I saw was not. I mean that the water fell within fifteen half that fall. That would not be navigable in my judgment. That would break a boat.

Assuming that in addition to the fact that the water for that 400 feet was 20 feet per mile of slope, that it was filled with large bowlders, as to what I would say as to the navigability of such a channel as that, I would say that it would be unsafe.

Being asked whether it would be possible, I could not say as to that.

As to assuming also that there is a crooked channel and a sharp turn at that point in addition to the fact that the slope is at the rate of 20 feet to the mile, and that it is full of large bowlders, what would I say as to that being navigable, I should say, so much would depend—it is a condition I cannot assume because of the placing of the bowlders. If the bowlders are placed in the channel so that a boat could be steered between them with care it might be navigable. Otherwise it might not.

Q. Well, assume that the bowlders were so placed that you could not even control a rowboat to get through them with safety, do you think that that point would be navigable for useful purposes of commerce?

2007 Mr. CRESSY. Objected to on the ground that the question is a hypothetical question and that there is nothing shown in the record on which to base such an assumption and the actual testimony will show contrary conditions.

The WITNESS. I should say it would not be navigable.

Being asked as to whether the better way to have seen that river for the purpose of determining whether it was navigable would have been to have followed the river all the way

down and not the road, I would say, I would see it that way, if I was going to devise a scheme for navigation.

As to why didn't I go down the river in a boat, and whether that wouldn't have been the better way, I will say I was not getting ready to plan works for it or I would. Nobody suggested my going down in a boat.

As to seeing any boats on it, I don't recall that I did.

Being asked whether it occurred to me that if I was dealing with a navigable stream, the natural way to have investigated it and examined it would have been to go down the stream itself, I would say, that is the better way.

Q. Isn't the reason why they didn't go down because it was not navigable?

Objected to as not proper cross-examination.

2008 A. Of course I can't answer. I don't know what is in their minds.

Mr. CRESSY. I move to strike out the question and answer from the record.

The WITNESS Being asked whether I spoke about this stream having a channel at every point that I examined it and whether it is true that every brook except in an alluvial soil has a channel, I would say, in rivers with sandy bottoms I have seen cases where there was for a few days at a time—there was no channel where the water was equal clear across; but ordinarily there is a channel forms in every river, a deep place. It may be ever so crooked but it is there. It is so in the smallest stream as well as the largest. There is always a point which is the deepest place which is called the channel. The thalweg is there except in sandy streams occasionally it is not there for a day or two.

Being asked whether when I say that this stream is navigable now and whether as conditions exist along that river now it can be navigated for useful purposes of commerce, I would say, I have not examined into the commerce, and am not familiar enough with it to state whether it can be

2009 profitably navigated or not. Those are questions that would have to be decided later. At the point I saw there was water enough for navigation and it certainly was navigable at these points. That is all I can say. Being asked whether I observed certain bridges, I will say, yes.

As to what I say as to its being possible to navigate that stream now with boats adapted to carry on a useful commerce in view of the obstructions which I saw in it, I would say you can carry useful commerce under every bridge I saw, but

you wouldn't do it with steamboats with stacks. But the gasoline boats have no stacks and sometimes the pilot house is on the ground floor, or practically there is no pilot house, you might say. And I think that every bridge I saw they could go under. As to how many feet of clearance would you have to have above your boat, I would say I know gasoline boats that are going under bridges eight feet high.

I never saw a gasoline boat climbing slopes such as exist on this river. I have had no experience with gasoline boats having been used on slopes such as are contained in this river—not on such slopes as here, but on steep slopes.

2010 *Re-direct Examination by Mr. Cressy.*

I was asked on cross-examination in reference to the slopes I considered when I answered the question as to the navigability of the river. I was given by the Assistant District Attorney certain plates of the Desplaines river. Those I have here. That is the profile, and that is the map of the territory. (Handing documents to counsel.)

Mr. CRESSY. I will show these to counsel for defendant and tell him that they are the exhibits which are marked Cooley Exhibits 2 and 3 in this case, with the privilege that he may check up and see if that is correct. (Handing documents to counsel.)

2011 The WITNESS. I examined these profiles which have been shown me before making an investigation of the Desplaines river. It was stated to me what the slopes were at the various points upon certain reaches. Mr. Cressy stated them to me, and Mr. Heilbron also gave me the slopes, and I took them from the profiles myself by scales as nearly as I could.

Q. How did the map compare with the slopes as given you by Mr. Heilbron, Mr. Cooley and myself?

Mr. SCOTT. That is objected to. It does not appear what slopes were given by Mr. Cooley, Mr. Cressy and Mr. Heilbron; and the conclusion of the witness as to how they compared is not competent; that the slopes as given to the witness should be stated and then it will appear how they compare by a reference of them to the maps and the profiles.

Mr. CRESSY. In answer to the objection will you state what the slopes were, as given to you?

The WITNESS. From dam No. 1 to Brandon's Bridge 20.85 feet, being a little less than 7 feet per mile; from dam No. 1

to Hickory creek, 13.3 feet. The fall at Treat's Island, 9.55 in about a mile and a half equals 7.6 feet per mile. At the mouth of the river 3.3 feet .6 of a mile, making about 5 feet per mile. Total fall 38.73 in 15.7 miles. Those are the
2012 slopes that I had in mind when I examined the river on December 28, 1910.

Being asked if I was asked on cross-examination whether supposing the left hand channel at Treat's Island had a slope of 16 feet at the head of the island and 17 feet at the foot of the island; and whether on the day that I examined the situation at the head of Treat's Island, as to whether I found any such slope of 16 feet to the mile, I will say there was nothing to indicate such a slope as that. I had a memorandum as to the slope at the head and the foot both of Treat's Island and that I had made from the map and that I have here. The head, 10 feet per mile; the foot, 10 feet per mile; the first in 1500 feet, the second in 750 feet.

As to having in mind the velocity of the water which I found at the head of Treat's Island and whether I would have had any such velocity as I found there on the day in question, if there had been a slope of 17 feet per mile, I will say, no, the velocity was too small for so great a fall as that, that day.

2013 *Re-cross Examination by Mr. Scott.*

Being asked whether if it should turn out as a matter of actual measurement that there was such a slope of 18 feet at one end of the island and 17 feet at the other per mile, then my conclusion drawn from the apparent velocity of the water must necessarily be wrong, I would say the velocity of the water would determine it.

As to whether my observation of it with my eye in my judgment would be of value if by an accurate examination and measurement it was found that the slopes were those which have been stated, I would say, observation could not possibly stand against actual facts if they existed.

As to whether I made any measurement of the velocity at the head of Treat's Island, I will say approximately only. That was one of the points where I had a stick or something thrown into the river. The point on the bank where that was thrown in was the island bank. I was pretty well to the head of the island at that time. I could not say how close. I followed that stick three hundred feet as I remember.
2014 I made a measurement of the velocity at the foot of Treat's Island in the same manner; that is the other place that I spoke of, throwing the stick in, unless I am mis-

taken, very much mistaken. That would have been at the foot; I say that is where we went out through the field and I take it that is the foot of the island. That was from the land side. We threw that from the land side. That would have been the foot of the land side, if that is the foot of the island.

Q. Are you at all clear that it was at the foot of the island where you went through the field and threw the stick?

Mr. CRESSY. I can state, if you would like it in the record, just where it was.

Mr. SCOTT. Yes.

Mr. CRESSY. It was at the mouth of DuPage creek where the second stick was thrown and not at the foot of Treat's Island.

Mr. SCOTT. It was not at the foot of Treat's Island.

Mr. CRESSY. No.

Mr. SCOTT. Then under the statement of Mr. Cressy you did not throw a stick to gauge the velocity at the foot of Treat's Island.

2015 A. I did not. So that whatever I did do at the foot of Treat's Island was simply by way of observation as to the velocity. We went onto Treat's Island by a bridge. We went onto two bridges; went onto the island on a bridge and then went off on a bridge. We went off on the right side from here. We went through a field and onto the island and then up to the head of the island, and then walked down to Brandon's bridge if it is on Treat's Island, on Smith's bridge. Whatever bridge is there, say a quarter of a mile below. We came over on one bridge on the right side of the river and we went off at a bridge at the left side of the river. That is

2016 Millsdale. We rode up to the head of the island and walked back. We rode very nearly to the head of the island in an automobile. We did walk some, but I think one automobile, and may be two, went up to the head of the island in that field. I know we walked back. Then we came back to the bridge and crossed over it under the left bank. And that road was then followed down the mouth of the DuPage river, I should say what they said as to being the DuPage river that was the next place, but I am not clear on those things at all, as I say. I only saw that country one time. I got in the automobile again at the bridge, and did not get out again until we got to this next point, wherever it is. That is my recollection.

Being asked whether we did not get out to make an observation at the foot of Treat's Island, I will say I could not say as

to that. I don't remember except where we went into the field and I don't remember all of those. As to which side of the river the DuPage river is on, it is on the right bank as I remember. The DuPage comes in from the right bank
2017 going towards the mouth of the river. We were going down on the left bank. Whether or not there is a fall of 17 or 18 feet to the mile at the foot of Treat's Island I did not observe. I checked up the slopes given me by these profiles. I first made—from the profiles I made a list of the falls at the steep places on the river, and then I was told by Mr. Cressy and also by Mr. Heilbron as to these falls. I checked up by the profile. I scaled with a scale. The vertical lines on this profile are a thousand feet apart.

Being asked whether it is possible to accurately measure the slopes on a map upon this scale, I would say, no. I have Major Marshall's survey in my office at Cincinnati. I did examine that. That shows the depths upon a scale which is measurable. I did not measure them upon that. I did read the report and looked at the map in connection with the report.

Being asked whether I checked up the depths as shown
2018 by Marshall's survey with the depths that were given me, I would say I checked no depths at all. I did not check up slopes by Marshall's survey by the slopes given me by the United States. I did not figure Marshall's slopes at all except what he gave me in his report. I did not compare the slopes as given in the report with the slopes as given me by the United States Attorney. I said that there are 13.3 feet from dam No. 1 to Hickory creek. That is the fall in that distance, 9800 feet.

Being asked whether navigability is determinable by average slope or by a slope at particular localities, I would say, by slope at particular localities like the links of a chain. The average slope would have something to do with it. With an open river it would have very much less, of course, than it would for a channelized river. I gave the slopes from dam No. 1 to Brandon's bridge, 20.85 feet.

2019 Being asked whether I ascertained what the maximum slopes were in that stretch, I will say I have 12 feet in 6,000, which will be 2 feet to the thousand. That will be 10 feet to the mile approximately. I have got that note here. As to whether I find at a certain portion of the distance between dam No. 1 and Hickory creek that it was 15 feet to the mile, I would say I don't think you can ascertain it that closely on that profile. I did not ascertain it from any source.

I just simply put down the slope as 10 feet to the mile or 12 feet in 6,000 from that scale. You cannot determine those slopes from this profile. Not directly accurately. I don't have the distance to Treat's Island from Brandon's bridge. The next distance below Brandon's bridge, Hickory creek to
Brandon's bridge, is 8.3 feet in 4000 feet; that is about
2020 10 feet and a half to the mile, roughly.

Being asked whether I examined the river in the neighborhood of Hickory creek and in the stretch from Hickory creek to Brandon's bridge where I say this slope of about 10 feet to the mile, I would say I do not recall except that Hickory creek was—I don't recall just where it is now, although I know we had it and mentioned it and talked about it but I cannot locate in my mind now whether we were there or not.

As to whether or not in that stretch from Hickory creek to Brandon's bridge there were a number of islands, I will say I cannot locate them; we saw islands as we went along. As to whether or not there were many boulders visible in that stretch, I will say the only boulders I recall were at the bridges.

Being asked as to whether I saw any in this stretch from Hickory creek to Brandon's bridge, I would say, I couldn't say. That is all, I can answer it that way. Being asked whether I observed that the channel was very tortuous
through many islands, I will say yes, wherever there
2021 were islands the channel was somewhat crooked. As to
whether I took those islands and those elements as to the tortuous and crooked channel into consideration in passing upon the navigability of this river, I will say yes. That was one of the problems that entered into it. I have no idea how many islands there are between Hickory creek and Brandon's bridge. I did not endeavor to determine where the channel lay among those islands. Being asked, how do you know that there was any navigable channel among them, I would say, of course I don't know only at the points that I saw. The next distance I gave going down the river where I gave the slope was Treat's Island.

Q. You have shown the distance and the slope between some other point and Treat's Island; what other point?

The WITNESS. I have not got any distance to Treat's Island at all on my paper here.

Mr. SCOTT. Didn't he give the slope below Brandon's bridge to Treat's Island?

Mr. CRESSY. No.

The WITNESS. I gave a certain distance over which the slope went after getting to Treat's Island.

Mr. SCOTT. After getting to Treat's Island?

The WITNESS. Yes, that was a mile and a half, 9.55.

2022 Q. That one-half that you gave there as a mile and a half, how do you know that is a mile and a half?

The WITNESS. That was the statement that was given to me by Mr. Cressy, and these other men, that I had. I did not verify that in any way. I verified it to this extent. My fall was 10 feet to the mile at both the head and the foot, and their statement gives 7.6 to the mile over a longer distance. I just took the short distance. Being asked as to where I got the 10 feet to the mile at the foot of Treat's Island if I made no observation from there, I would say from that map. From that profile, I got all my slopes from the profile that I had originally. Being asked as to whether so far as these slopes are concerned my conclusion would have had just the same weight if I had not seen the river at all, I will say, no, that is not right. So far as the slopes were concerned, I took them from the profile and what was stated to me by the counsel for the United States. I added observation to that where I looked at the river. Being asked, whether in places where I did not observe the river I depended upon the statement of the United States attorney and the engineer, I will say

2023 I made no statement except where I observed it. Being asked whether I stated that I made no observation at the foot of Treat's Island, I would say, if I did not then I make no statement as to its being navigable at that point, that is all. I don't say I didn't make any there; I don't know. The river is navigable wherever I saw it, that is all. Nothing more. No suggestion was made to me that I examine the Desplaines river above the point where the waters of Lake Michigan were discharged into it by the Sanitary District channel where the waters of Lake Michigan were not contributed to it. The examination was entirely below the dam. My reason for that is that I was not asked to.

Re-direct Examination by Mr. Cressy.

2024 Q. Mr. Thomas, if you are given the slopes and are able to observe a river at five or six points at which the river is the shallowest and the swiftest and the narrowest, what are known in engineering terms as the controlling

points, are you able to pass an opinion as to the entire river between the points mentioned?

A. If I have seen the worst points on it I can decide as to those.

Mr. SCOTT. I move to strike out the answer as not being responsive to the question.

Mr. CRESSY. Read the question and answer.

(Question and answer read.)

The WITNESS. I assume that if you can get over the worst points you certainly can get over the best.

Mr. SCOTT. I repeat the motion to strike out the answer as not responsive to the question.

Q. So that if a river was navigable at its five or six worst points it would be navigable, Mr. Thomas, would it not, at other points, where its condition was not so bad, along the lines mentioned?

Mr. SCOTT. That is objected to as calling for a conclusion and incompetent and immaterial and irrelevant.

Mr. CRESSY. You may answer.

A. Yes, sir.

2025 *Re-cross Examination by Mr. Scott.*

Being asked whether you have to have some other elements than swiftness, narrowness and shallowness, I would say, if you have width and depth and lack of velocity, too, you have got the three main elements in the problem. There are other elements, however, that would enter into it to a certain
2026 extent. The presence of obstructions in a channel. The presence of obstructions which cross overhead, bridges. The width of your deep water—well, that has been given in width. The flow of the stream, that should have been first, that is the important thing; if you haven't got the flow, you haven't got anything. If you haven't the discharge you come back to your dry land then. The sinuosities of the stream have something to do with it in an exceptionally crooked stream, but the width was given; if you have width you can overcome your sinuosities, but you have got to have width to turn in to do it. In these places that I saw there was width sufficient to swing your boat. There was ample width at every place I saw except where a bridge abutment had been built out in the stream. The width you would require depends on the character of your boat again. If you have a little boat you don't require much width. The kind

I am used to, the little ones; as I say they are about 14-
2027 inch boats for draft, and, as I say, they carry about 60 tons. With gasoline they are less, but with steam they run from 80 to 130 feet; but the gasoline boats are run now from 65 feet down sometimes less. They don't carry very much.

Q. Is it your opinion that in a channel 65 feet wide, rock bottom and bowlders, with a slope of 10 feet to the mile, you can handle a boat 120 feet long, the channel being crooked?

That is objected to, on account of the form of the hypothetical question, no foundation for which has been laid by the evidence in the case.

The WITNESS. The question as I understand it with the channel 60 feet wide, on a bowlder bottom, this channel being crooked, can you navigate a boat 120 feet long with a slope of 10 feet to the mile. It can only be done by putting out a line, that is cordelling again. And to cordell, what depth of water you would require depends on the boat again.
2028 If that boat was drawing 14 inches, I would want 18 inches at least over the bowlders over the bottom. A boat of size carrying 60 tons would draw probably two feet and a half. You would need over the bowlders to cordell that boat under such conditions, a clearance of 6 inches, if you can get it, although you are not making much speed. That would be 6 inches added to the 30, 36 inches. Taking the 60-foot boat under the same conditions, a 60-foot boat would be wider to carry the same amount of freight, of course; it would be necessary to cordell that, but you could make your turns very much better than you could with the other. You would require in depth over the bowlders the same amount of water if you were carrying the same amount of freight. As to what about cordelling where the banks are covered with timber, I will say unless the timber is overhanging considerable, there is no trouble about it. Most of the cordelling done where I am used to it, the timber is a help, because you tie your
2029 line to it. That is all, but, of course, our banks are higher than here.

Q. Assuming that the timber is overhanging in such a channel as I have indicated, how about cordelling?

Objected to on the ground there is no foundation in the evidence for the hypothetical question.

The WITNESS. For a boat low enough to go under the bridge on the Desplaines river, I don't think any timber would interfere. As to assuming that the slopes, instead of being 10 feet are 16 and 17 feet per mile; what, then, could I do with

such boats as I have been talking about in such a channel, I would say, such boats as I have observed, would not have enough power to take a load against that current for any great distance. They might do it for a short distance, say two or three hundred feet, something of that kind; but in my judgment they could not do any navigation on a long stretch of river.

Q. Did you ever see a boat undertake to overcome a slope of 16 or 17 feet, in such a channel as I have indicated, on the depth of water that I have indicated?

Objected to, on the ground that your question is a hypothetical question, and it does not specify what your depths are, or what the condition of your channel is.

Mr. SCOTT. I think it does. Read the question.

(Question read.)

2030 Mr. CRESSY. What is the first part of that question there, "As you have indicated"? What have you indicated?

Mr. SCOTT. I have indicated a channel above there as to which he has been answering right along for sometime.

Mr. CRESSY. What is that channel or the basis of the hypothetical question?

Mr. SCOTT. Do you remember the basis of my question, Mr. Witness?

The WITNESS. 60 feet wide was your channel. Now, with a fall of 17 feet to the mile, I don't think that the boats I have named would go for any distance; probably two or three hundred feet would be the limit.

Being asked whether I ever saw any go two or three hundred feet in such a channel as I have indicated on the depth of water I have named, I repeat, I could not swear as to the fall, but a fall that would approximate what you say would be over a dam. The depth of the water except immediately on top of the dam would be greater above and below, but you would have to pass the sill of the dam. How high it was

2031 on the sill of the dam, I couldn't say now. It has been sometime since I had anything of that sort. Going over a dam is a difficult thing on account of your boat, the length of it; the stern of your boat is going up hill while the bow is level, and your boat tends to break in two on the sill; there is the trouble. Being asked, what would happen in a case where there is no dam, going up such a slope as I have indicated, if your line broke, I would say, you would drop back. Of course, you would have to bring your rudders into action, and hold

her in the river until you got your line out. As to what you could do with a rudder, with a boat in a swift stream with a declivity like that, 60 feet wide, I would say you are liable to be in trouble.

Q. Now, coming back to this dry land business, it is possible to cordell a boat on dry land, isn't it?

The WITNESS. Why, yes, on rollers; possibly some other way.

Mr. CRESSY. I move to strike out the last question and answer by counsel for the defendant.

2032 HORACE S. BROWN, called as a witness on behalf of the Government, testified as follows:

Direct Examination by Mr. Cressy.

I reside at Quincy, Illinois. I have been contracting most of my life. Mostly on Government river improvements and harbor work. I am seventy-three past. My experience has been contract work in reference to rivers. My experience with rivers began in 1855. I was employed on the im-
2033 provement of the rapids at Keokuk, removing reefs and rocks in the channels. That is Keokuk, Iowa. The work was on the Mississippi river. As to what I did do in reference to the improvement of those rapids. Well, we took out patches of rock and cut off points of rock, and deepened the channel in places. That is mostly making the old channel—facilitating the passage by taking out patches of rock that were scattered along in it. I had occasion in my work there to navigate boats up and down that rapids, to some extent, that is a towboat occasionally. The boats that were used were not self-propelling; dredge boats and drill boats, derrick boats. As to what I can say in reference to the velocity of the current of those rapids, I don't know that I could say that I know positively as to what the velocity of them was. It varied greatly in places. There were chutes where the current was so strong it was impossible to get along with a rowboat or a yawl. You could not stem it. After my experience at Keo-
kuk, I was next employed on the Falls of the Ohio, near
2034 Louisville. I was employed there, a couple of years. My work there was taking out rocks at the entrance of the canal, and making a clear opening of the river into the

canal under water excavation. My next experience was in the navy during the war and remained there for three or four years. Then after the war was over I went on the Rock Island rapids, which was the same kind of work, for the Government. I worked there five years. That would be from 1867 to 1872. From 1872 I was on the Illinois river for two or three years, and on the Mississippi; I went from there to the Ohio river; five or six years on the Ohio river. Part of this time I was in the service of the Government; well, all of this time until within the last four or five years I have been a Government contractor, and doing work for the Government under contract; but I think during 1870 and 1871; I was employed by the Government directly part of the time, just for a few months, I think. That is, paid a salary. Since
2035 1870, or thereabouts, I have not been paid a salary by the Government. My work has been under contract with the Government. As to the rivers and at what places on those rivers I have done work under contract for the Government in reference to the improvement of the rivers, I will say on the Illinois river from Peoria down at different points where there were bars, we removed the bars; put in some wing dams, and brush and stone. On the Mississippi at Alton and St. Louis, and at quite a number of points between Keokuk and Alton; wherever the Government directed the work to be done we went there and did it. Quincy. As to what I have done on the river in reference to the improvement of rapids, I will say we had our dredgeboat working there for six years, six summers, at different points from Logstown bar, which is near Pittsburgh, clear to Mt. Savage, which is near the mouth of the Ohio river, over a scope of nine hundred miles, at different places.

Q. In general what was the minimum depth over these various bars that you had contracts for improvement, prior to the improvements?

2036 Objected to as being so general in its nature that upon cross-examination it would be impossible to indicate, or to get at the particular places referred to; and further objected to that it is incompetent to prove generally in this way what were minimum depths, without specifying the river, or indicating in any way the points, or asking the question as to what river, or what point; and further as being incompetent, immaterial and irrelevant.

COUNSEL FOR GOVERNMENT. You may answer the question, now, Captain, and in your answer in response to the objection

of counsel, you may state the minimum depth at the different bars that you have had occasion to improve, mentioning the bar at which is the depth that you refer to.

COUNSEL FOR DEFENDANT. Objected to as immaterial, incompetent and irrelevant.

The WITNESS. At Logstown Bar on the Ohio river, we had a depth of 15 inches for quite a distance. I think that was the ruling depth on the bar. That was 15 inches. At Sisters Island on the Lower Ohio, we had a depth of 17 inches. At the Mr. Savage Bar we had a depth of 19 inches. That was during the low water at the times we were working on it.

2037 Those were all on the Ohio river. I don't remember about Schuylkill Bar on the Ohio river, what the depth was there prior to the improvement. At Flint Island Bar, I think when we were there, there was about 22 inches prevailing depth. Being asked if those were the bars that I have mentioned, namely the Logstown Bar, the Flint Island Bar, and the Mt. Savage Bar and were they improved to any particular depth, and if so what depth, I would says they were improved to about 3½ feet; we expected to make 4 feet. We did not always do it, but sometimes we made a little more than that. I am familiar with the swift currents on these rapids. Some of the swift currents that I have had to contend with on these various rapids I have improved in connection with the current, were on the Rock Island Rapids, what is called the Moline Chain, and Sycamore Chain, a very swift current. These were so swift that it took pretty good navigation for the ordinary steam boats to pass up over them. That is they had to carry excess pressure of steam when they were going up stream. On the Keokuk Rapids there

2038 were places where the steamboats almost always put out a warp, put an anchor out, and pulled through with the anchor line, and capstan. I have no method of judging how swift the currents were of these rapids at Rock Island and at Keokuk, only by the velocity of the steamboat that would make ten miles an hour in the slack currents, in the river coming up from St. Louis, the ordinary current where there was only five or six inches fall to the mile; those steamboats would pass up over these rapids through these swift points in these rapids by carrying excess pressure of steam. Sometimes if the wind was not favorable, or under other circumstances they would put out a warp and warp through. You gentlemen used the word cordell here, and it is not applicable to a steamboat at all. It is only applicable to a boat drawn by hand. Excuse the

digression though. I am familiar with the swift current on the Tennessee river, below Chattanooga, at a place called the Suck, and at several places, what is called the Little Mussel Shoals; very difficult of navigation. I did not work on those rapids. I did some work on the Tennessee river, but not on those points; but I have been at those points.

Q. How great a current is there at those points?

Objected to as there is no foundation laid for asking
2039 the witness as to his conclsuion as to that.

The WITNESS. I could not say; I only know from hearsay.

COUNSEL FOR DEFENDANT. I also move to strike out his previous answers as to Keokuk and Rock Island velocities.

The WITNESS. I have had occasion in my work to inspect rapids and swift currents previous to their improvement so as to determine the question as to whether there were bowlders lying just beneath the surface of the stream. I am able to tell by inspecting a river as to where the current of the river is, and as to where the bowlders lie, if any there be, being asked if a bowlder lies in a stream say from 6 inches to a foot beneath the surface of the water, is there any appearance on the surface of the water to indicate a bowlder at that point, I would say there is, if there is any velocity to the water; if the water runs with any—if the current is strong. A
2040 current between 3 and 8 miles an hour would show if there was a bowlder or patch of rock. A current three miles an hour would show a bowlder lying a foot beneath the surface. The indication would be a whirling motion at the top, or a break in the uniformity of the current; otherwise the current would flow even; if it did not flow smoothly it would flow with a sort of uniform system of waves or ripples and if there was an obstruction in there like a bowlder, or a patch of rocks, it would make a break in that uniformity by showing an eddy, or a slacking of the current just at that point. I have had occasion in my experience to locate and remove such bowlders, particularly. As to what I mean by particularly, I say that because I was employed for the purpose of locating these and putting the machines to work on them. I made an examination of the Desplaines river from Joliet, Illinois, to its mouth on the December 28, 1910, in company with Mr. Thomas of Cincinnati, I observed the river paying particular attention to the question of the location of the current of the stream, and as to whether or not there were

any bowlders in the stream at the various points which
2041 were shown me by counsel.

Being asked as to whether I examined the river first, at Brandon's bridge, with the immediate idea of ascertaining the location of the current, and the question of the location of the bowlders at that point, I would say, yes, sir, we did.

COUNSEL FOR THE GOVERNMENT. For the purpose of calling the attention of the witness to the question, I will point out Brandon's bridge at that point there (indicating on document).

The WITNESS. This is down stream; here is the mouth
2042 of the river. That is Brandon's bridge (indicating).

That is Treat's Island. There is no bridge between Brandon's bridge and Treat's Island bridge. When we came across this bridge onto the other side of Treat's Island—oh, that is it; this is Treat's Island (indicating).

Q. Having this map before you, I will ask you as to whether you observed, standing on Brandon's bridge, certain small islands above there, and if your attention was particularly called to the location of the channel up there on December 28, 1910.

Objected to, as leading.

The WITNESS. We particularly looked at the river from Brandon's bridge, got off the car, and walked across, and evidences so far as I could judge from the appearance of the river shows that there was a navigable channel clear of any indication of bowlders.

COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive.

2043 COUNSEL FOR GOVERNMENT. Just read the question and answer specifically, and then I will ask you another question as to what you found. Answer the question asked first.

(Question read.)

The WITNESS. Yes, it was. The condition above Brandon's bridge looking up stream looked to be clear. Being asked if I was able by reason of my experience on other rapids to ascertain where the deepest water lay, I will say, no.

Q. Were you able to pick out a channel on which you could navigate above that bridge?

Objected to, as calling for a conclusion of the witness, and as not containing sufficient data to make the testimony of any value; and further as calling for testi-

mony as to the condition of the river not in a state of nature.

The WITNESS. I could not determine from what I could see where the channel was.

Q. Are you able to state as to whether or not, the river could be navigated at those points?

Objected to, as calling for the conclusion of the wit-
2044 ness, and as not containing sufficient data to make the testimony of any value; and, further, as calling for testimony as to the condition of the river not in a state of nature.

The WITNESS. I believe the river could be navigated at the points where I saw it.

COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive to the question.

The WITNESS. There were bowlders in the stream at Brandon's bridge.

Q. Would those bowlders obstruct navigation?

The WITNESS. Not necessarily entirely so. You could pass between them or around them.

COUNSEL FOR DEFENDANT. Read that question and answer.

(Record read.)

COUNSEL FOR DEFENDANT. I want you to read that answer to the witness again, Mr. Satterlee, and ask him as to whether you are giving it just as he said it.

(Answer re-read.)

COUNSEL FOR DEFENDANT. Is that your answer?

The WITNESS. Yes, sir. Being asked if I examined the
2045 condition of the Desplaines river at the head of Treat's Island, I would say I walked with the party out to the head of the island. I did observe the swiftness of the current, the location of the current, and ascertained the condition of the water in reference to whether or not there were any bowlders present in the stream at the head of Treat's Island. We found an apparently clear channel there; plenty of width.

Q. Would you say that there were or were not bowlders in the channel which would interfere with the navigation of the channel?

I object to that as calling for the conclusion of the witness, and not as to the fact whether the bowlders were there or not.

COUNSEL FOR GOVERNMENT. In answering that question, basing your answer upon your experience in reference to the detecting of the location of bowlders, you may state whether

or not there were any bowlders in the channel at the head of Treat's Island.

Mr. SCOTT. Objected to as incompetent, immaterial and irrelevant.

The WITNESS. I could not see any indication that there
2046 were any bowlders. I think if there had been bowlders there, there would have been indications that I would have been able to detect. As to whether I examined the Desplaines river at the mouth of the Du Page, I will say if I have the location right in my mind I did. It is below the Millsdale bridge.

COUNSEL FOR GOVERNMENT. There is the Du Page coming in at this point here (indicating).

The WITNESS. This is the bridge (indicating).

COUNSEL FOR GOVERNMENT. Here is the Smith bridge here.

The WITNESS. Did we cross the Smith bridge at all?

COUNSEL FOR GOVERNMENT. Yes, we went onto the Smith bridge.

The WITNESS. Yes, we didn't go across it.

COUNSEL FOR GOVERNMENT. No. I will call your attention to the particular point where we drove up to the farm house and went through the lots.

The WITNESS. Yes. We left the automobile and got out and walked down the stream to that point. My recollection is that the river at that point was crooked, and at that point was obstructed by a bar. It don't impress me that there was a very strong current there, or a great fall as there was up at the Millsdale bridge above there. I think I did not see anything to indicate the presence of bowlders at that point.

2047 Q. Supposing, you were shown on December 28, 1910, the Desplaines river at the point at which the swiftest current prevails, being the point where the river is the shallowest, and the narrowest, and the most difficult to navigate; would you say that a boat could be navigated on the Desplaines river in the condition that existed there on December 28, 1910.

Objected to, as calling for the conclusion of the witness, as to conditions not existing in a state of nature; as assuming certain facts not shown by the evidence, and as incompetent, immaterial and irrelevant; and, further, that no proper foundation has been laid for the opinion of the witness in this case.

COUNSEL FOR GOVERNMENT. In answering that question you

will bear in mind your experience on the various bars, and other rapids which you have improved.

The WITNESS. I will have to ask you to read the question again.

(Question read.)

COUNSEL FOR GOVERNMENT. From the mouth of the river to Dam No. 1, at Joliet. Now you may answer.

The WITNESS. Well, I would like to qualify that by saying I believe there are boats made that would navigate that river at that time; whether that would be considered an excep-
2048 tional case or not. I would not say that I believed it was navigable for practical purposes, under ordinary conditions at that time. If I could answer the question in that way. Being further asked, as to my opinion just what I think the condition of the Desplaines river was on December 28, 1910, as to navigation in its present condition, I will say that I believe the navigation of it is possible. As to having
2049 found other rivers whose conditions were in any ways similar to the Desplaines river as I found it on December 28, 1910, I will say I have worked on rivers that were in fully as desperate a condition as that was and were made navigable afterwards.

Take the falls of the Ohio for one. The falls of the Ohio were not navigable originally only in high water. They have been improved until—and I am not talking about the canal, I am talking about the falls; the canal is one side of the falls. The canal is used as the river is used too, but the falls of the Ohio were a total obstruction until they put the canal in excepting at high water. And they were made navigable by improvement.

Q. Do you believe that the Desplaines river by improvement of the channel, that is the removal of bowlders and the cutting out of rock reefs could be improved so as to render navigation much easier?

Objected to, as incompetent, immaterial and irrelevant; and on the ground that the witness has already testified that the river is not now capable of practical navigation.

Q. Did you say that the Desplaines river, was not practically navigable?

Objected to; what he says appears of record.

The WITNESS. I said that I believed the navigation of it was possible but not practical.

By practical I mean that the condition that it was in at

that time would not induce anybody to put a steamboat line in there or a boat in there with the intention of making a living out of it.

Q. Could the Desplaines river be improved in the method that other rivers have been improved which you have worked upon?

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. Yes, it could be largely improved. Just the removal of the bowlders for a channel of say 150 feet wide, and cutting off some rock points and perhaps putting in some wing dams to hold the water over into channels where it is divided by island. That would be a—mind I don't say that that would be a total improvement. I believe the total improvement is only effected by means of dams and locks. They may be submergible dams or these dams that are called wicket dams or they may be permanent dams, but the
2051 navigation could be improved largely by just removing the patches and boulders which exist in the natural channel you might say, and perhaps cutting off some points of shore line, straightening it.

Q. Judging from your experience on rapids, what would you say the depth of water was at the points at which you examined the river on December 28, 1910? Name the various points, giving the depth so far as you can judge from your investigation?

Objected to, on the ground that no foundation has been laid qualifying the witness to give an opinion as to those depths, and no investigation shown to have been made by him such as would warrant him in giving an opinion as to the depth.

COUNSEL FOR GOVERNMENT. In answer to the objection of counsel, you may state as to whether or not you are able to tell what the depth in the river is from investigation.

The WITNESS. I examined the profiles that Mr. Heilbron had as showing what the depths of water were at those
2052 places. I am not able to tell from the examination I made of the river as to whether those depths were correct or not. I would if I took a boat and sounded them, went over the water myself. Then I would know, but I would not know by just the cursory examination I made from the bridges.

Q. If it be shown, that the depths on December 28, 1910, were in the neighborhood of three feet, what would be the

depth which would be produced by the improvements that you have mentioned?

Objected to; no proper foundation has been laid for the conclusion of the witness upon that point.

The WITNESS. Well, the depths would not be largely increased. The improvements would consist in making a width of channel that would be clear of obstruction, giving room for a boat to navigate without danger of striking the banks or reefs on the outside of this channel that it was desired to improve. That would not increase the depth of the water very much because if you undertook to increase the depth of water you would have to go down in the bottom and excavate a channel through those shoal places. I could not tell, of course, how much of the river would have to be opened that way. In doing that you would interfere with what the engineers call the regimen of the river and perhaps lower
2053 the water in the pools and bring about a condition that would take an engineer to decide what to do. My own idea was that I could improve the navigation of the river which would make it practical, by just insuring a width of perhaps a hundred and fifty feet and a clear bottom.

Cross-Examination by Mr. Scott.

As to how far up the river I could see from Brandon's bridge, I judge about half a mile; you can see as I remember it—without—the vista of what you can see in front of you would perhaps be obstructed by a bend up perhaps about a half a mile. Being asked if that bend isn't considerably nearer the bridge than half a mile, I could not say now. As to how long I remained on Brandon's bridge, I will say probably twenty or thirty minutes. I did not make a detailed examination of these boulders and islands as to assure me that you could pass around or between them. Being asked if I
2054 mean by my answer that if I could pass through those boulders, that then it would be possible to take a boat over, I will say, I meant to say that they did not appear to be so but what you could pass them without touching them. I did not locate the channel. I only just suggested to my own mind where the channel would naturally be. To determine whether one could actually pass among those boulders, I would have to locate the channel; and get that out of a small boat by soundings. Being asked if it should appear that

throughout that stretch of the river there were boulders across the entire river, two, three and four feet high and near together, would it be possible to take a boat used in trade and commerce over that stretch, I would like to qualify that a little; you didn't say how much water there is on top of those boulders. Being further asked to assume that as to some of those boulders there is no water on top of them, and that others are from three inches to two and three feet below the top of the water, I would then say without there was
2055 sufficient water over the boulders, as you have described them, there would not be any navigation. As to how much water would be necessary over those boulders to permit of navigation, I would say there ought to be two feet of water. Being asked where the bottom was entirely smooth is not the surface of the water smooth, I would say not where there is a velocity, not where there is a strong current. Being asked whether the top of the water isn't smooth, even if swift, where the bottom is smooth, I would say, if you have a perfectly smooth bottom, I suppose it would be. As to whether the water there at the surface was smooth or turbulent, I would say it was broken. As to how long we were at Treat's Island making our examination at the head of Treat's Island, I suppose we were there at the head of Treat's Island a half an hour and then walked down the shore to the bridge. I did not make a careful, detailed examination to ascertain what boulders there were in the river at the head of Treat's Island and in the channel.

2056 MONTGOMERY MEIGS, called as a witness on behalf of the government, testified as follows:

Direct Examination by Mr. Cressy.

My residence is at Keokuk, Iowa. My occupation is United States civil engineer. I have charge of the operating and care of the Des Moines rapids canal, of the improvement of the Mississippi river, and of the construction of boats and dredges at the dry dock. I hold a position under the United States in the Engineer Department; that is a sub-branch of the War Department. I have been at Keokuk since 1882.
2057 As to my experience in engineering, I was educated for two years at the Lawrence Scientific School at Harvard College, Massachusetts; then I was two years at the Royal

Polytechnic at Stuttgart, Germany, which is an engineering school. Then my first work was on the Northern Pacific Railway, the survey and construction of that; three years. Then I went abroad for a year in 1874. Since that I have been engaged in the survey of the improvement work on the Mississippi river under the Engineer Department.

As to the nature of my employment for the Northern Pacific Railroad, I made surveys and built a track, built a subway. In that survey I had experience on the Yellowstone river. We made a survey up the Yellowstone river from Bismarck on the Missouri to the mouth of the Big Horn on the Missouri and Yellowstone. While we were there the outfit was supplied by steamboats which brought the supplies around and up the Yellowstone. The Yellowstone is a very rapid and small stream, many swift places in it, and one occasion they took the steamboat and made an exploring trip up the river above Glendive which was the objective point where we

2058 received our supplies—took the steamer and went up the river to Wolf Rapids, it is called, where there is a very swift stretch of water. I think that was about the swiftest water I ever saw a boat navigate. How swift that water was, I have no means of telling, but they swelled the boat up with steam until it was pretty dangerous, I guess; until she went up in fact, as used to be the style on the Missouri river; until she got steam up and then let her go. This rapids was a swift piece of water; it roared so you could hear it a mile away, so it must have been very swift water.

During my stay at Keokuk, I have made a study of the slopes and currents that are found on the rapids at Keokuk. As to what the slope is on the Mississippi through the Keokuk rapids, I would say, there is a general slope at low water of 22 feet in 12 miles. That is from Montrose to Keokuk. As part of my official duties there, I have had occasion

2059 to investigate the conditions that prevailed there prior to the improvement of the rapids. Prior to the improvement of the rapids, at low water there was no navigation. That is, there was not more than 12 inches of water in the channel; even in the improved channel. The rapids at low water are divided into pools more or less separated by reefs where the water is swifter and shallower. The improved channel was not over 80 feet wide. The width was determined by boats of a known width walking their wheels on the rocks on both sides when ascending the river, so they knew exactly how wide it was. 76 feet was the actual width I was

9588

told. That point was at one of the different chains; I think it was the English chain. As to what the slope was in these chains or riffles, at low water, I don't know what they were. They would figure up a great deal in a mile; of course they were short. At high water the condition of the rapids or riffles was all smoothed out and navigable for any boat that had power enough.

The canal was opened in 1877. Being asked: whether when I took charge there in 1882, was the canal completed or was it necessary to do additional work there I would say I did
2060 considerable additional work in completing it. I had a good deal to do, of course, with rapids pilots. There was a rapids pilot named Robert Ferris who was called the "King of the Rapids Pilots," and he was in my employ for a number of years running a government tow boat, towing rock from the east side of the river over to the canal and down over the rapids before the completion and improvement of the works. I took a good deal of interest in the navigation and handling of the boats and talked with Ferris a great deal about the rapids, about the riffles and about the management of a boat on the rapids.

As to the method of getting boats over the rapids prior to the improvement, it used to be the custom as low water approached to divide the boats into two classes, the lighter draught and the heavier draught boats. They aimed to get the lighter draught boats above the rapids before the water fell and the heavier ones below the rapids. Very frequently it happened that a boat was not gotten over the rapids in time to escape low water, and then they had the means of finding out very closely what the depth—what the chan-
2061 nel was like in trying to get that boat down over thin water. They used to even take the shutters and doors and screens and every movable thing, the furniture, off of the boat, to lighten her sufficiently to get through, and the pilot could tell, oh I should say, within half an inch of just where she would rub and where she would float, so that they had an extremedy accurate and intimate knowledge of the bottom and of the depth. The Mississippi river is about three-fourths of a mile wide and the channel is 76 feet wide in one place. As to how deep the water was in that channel in low water, I would say that in low water at that place I should think a boat drawing 12 inches would stick.

Being asked: if I know as to whether they were able to

get boats up through there when there was 13 or 14 inches of water I would say I think not. They had a very light draught boat that did the transporting of the freight between the upper business and the lower business at low water. I think this boat—well my impression is she drew about two feet and all the freight was floated on barges and propelled by that boat as long as she could get through. When the water got so low she couldn't navigate, why they shipped the stuff by railroad. Earlier they used to ship it by wagon.

2062 As to whether I have had occasion to investigate the navigable condition of the Des Moines river as a part of my official duties, I would say, yes, two years ago I was ordered to make an exploration of that river, which I did in a motor boat from Des Moines to the mouth, a distance of about 185 miles.

Q. And what condition did you find in reference to the Des Moines river, taking the slope, the distance and any other matter that may be material to determine the question as to whether the river was or was not a navigable river?

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. The general slope was about a foot and a half to the mile. The bottom below Ottumwa was nearly all rock; about Ottumwa there were rocks and gravel. The river was more or less divided into pools as the water got lower and at extreme low water, why this year it could be waded half knee deep most anywhere. The distance from Keokuk to Ottumwa, I should say, is about 84 mile, 85 miles.

Q. What was your finding in reference to the navigable condition or non-navigable condition of the Des Moines river?

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. Well, I found by inquiry and by old

2063 records that something like 34 different steamboats had been employed in the navigation of the Des Moines. At one place I was told by one of the old inhabitants that he had seen 13 steamboats tied up above one of the locks when the dam was submerged on account of a high flood that prevented the boats from attempting the lock, and they collected there until there were 13 boats tied up in one bunch. This navigation extended over a series of years and came to an end some time soon after the war. My finding was that a river that had been navigated by as many as 34 steamboats could not be called anything but a navigable river.

The discharge of the Des Moines river at low water is about 360 cubic feet per second. The Des Moines rapids have been navigated since he canal was constructed, at high stages. When there is plenty of water, the boats descending the river prefer to go outside because it is very much quicker than to go through a long shallow canal with three locks. Generally
the ascending boats prefer to go through the canal be-
2064 cause they save coal, they don't have to fight the cur-
rent. At low water everything has to go through the canal, even the small John boats that go down the river come through the canal.

On December 28, in company with Mr. Cooley, Mr. Thomas, Captain Brown, Captain Ferris, and Mr. Heilbron of the Sanitary District, I made a trip down the Desplaines river from Joliet to its mouth. We crossed the Desplaines river at the various bridges in Joliet and then at a point where I was informed it was Brandon's bridge and Treat's Island and the mouth of the Du Page river, Kankakee feeder aqueduct and the mouth of the river, as well as I can recollect we crossed all of those bridges. I observed the width of the river, the velocity of the current, the amount of water and the general conditions that would have to do with the question as to whether or not a boat could navigate the river in the condition that I found to exist on that day.

Being asked, whether from my study of the Des Moines rapids in the Mississippi river and other studies which I have made, would I be able to find where the current or deep-
est part of the river was, I would say yes, why my ex-
2065 perience as a steamboat man would tell me where to find the current.

Q. Prior to your taking that trip you were asked, were you not, by myself, to bear in mind two questions, first as to whether the Desplaines river was navigable in the condition as you saw it on that day; and secondly, as to whether with improvement the river could be rendered navigable. I will ask you whether you made an examination of the Desplaines river at these various points which were pointed out to you as the shallow points of the river, with a view of determining those questions?

The WITNESS. Yes, I considered all those points and my conclusion was—

COUNSEL FOR DEFENDANT. One moment; I think counsel will instruct you that that would not be responsible to this question.

COUNSEL FOR GOVERNMENT. No, I will ask a question to cover that.

Q. What would you say was the current that prevailed in the Desplaines river, Major Meigs, at the bridges in Joliet? Were you able to determine that from your examination that you made that day?

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. I can make a guess at it. That would be based upon my experience.

2066 Q. How great a current do you think prevailed in the Desplaines river at Joliet?

Objected to, as incompetent, immaterial and irrelevant and as calling for the condition of the river as changed by the acts of man, and not as it existed in a state of nature; and for the further reason that no foundation has been laid for such an opinion of the witness.

The WITNESS. I have stated that I have had experience with swift currents and am familiar with swift currents.

Q. How would these currents that you found on the Desplaines river compare with currents on other rivers that you are familiar with?

Same objection, and on the further ground there is no specification of the currents counsel has in mind that he desires the witness to compare with.

COUNSEL FOR GOVERNMENT. I desire to leave the witness to make his own comparison with other currents that he is familiar with.

The WITNESS. My judgment of the current would be from my experience with what a steamboat could do, an ordinary steamboat such as particularly one small boat we have at Keokuk which I have handled a great deal, which makes

2067 ten miles an hour in slow water; now that boat would, in my opinion, climb a current of 8 miles an hour. She would make 8 miles an hour up the banks of the river, and looking at the water and judging it I thought my steamboat would ascend that current without much difficulty. I am now referring to the swift water beneath the bridges at Joliet.

Q. What would have been the condition at the other points in the river that you observed?

Objected to, as incompetent, immaterial and irrelevant and as calling for the condition of the river as

changed by the acts of man and not as it existed in a state of nature; and for the further reason that no foundation has been laid for such an opinion of the witness; and on the further ground there is no specification of what currents counsel has in mind that he desires the witness to compare with.

The WITNESS. The worst place I discovered was at the head of Treat's Island. I thought there was nothing there that a smart steamboat would not negotiate and tow a barge. I except the current opposite the dam at the mouth of the river; that I don't believe would be navigable for a boat
2068 up stream. I am referring to the condition at the cofferdam on December 28, 1910, as I saw it.

Q. Will you now answer the first question you were asked to consider in your investigation, namely, as to whether or not the Desplaines river was navigable in the condition that you found it on December 28, 1910, from the mouth of the river to Dam No. 1 at Joliet?

Objected to, on the ground, first, it is stated that at the mouth it was not navigable as he saw it; second, on the ground that it calls for the condition of the river as changed by artificial means and not as it was in a state of nature; and third, because no sufficient foundation has been laid for the conclusion of the witness.

2069 COUNSEL FOR GOVERNMENT. If I may say something for the purpose of saving the record, Mr. Scott, in asking this witness I particularly limited it to the condition on December 28, 1910. It hardly seems necessary under those circumstances to have the objection in reference to a state of nature, because there has been no intention on the part of the Government to ask this witness as to the condition in a state of nature.

COUNSEL FOR DEFENDANT. It is precisely for the reason that you ask its condition on December 28, 1910, that the objection seems to me to be necessary to the question, in that the question itself points out that it was directed to a time when as we understand the issues in the case the testimony would be incompetent, to reserve which objection it is necessary for me to take it.

The WITNESS. I saw no place where I could not take the Grace in my opinion and ascend the stream to Joliet from the cofferdam to one of those bridges. I would, of course, have to limit that by saying that there might be a boulder in the

center of the channel which would not show with such an examination as I made, that it would hit on; but I saw nothing that seemed to me to prevent the navigation by a small steamboat with proper power like the United States steamer Grace.

2070 Q. I will ask you now to answer the second question, Major Meigs, in reference to whether or not the river could be improved at slight expense and rendered easy for navigation?

Objected to as incompetent, immaterial and irrelevant and as starting the improvement in a condition which is not in a state of nature.

The WITNESS. I think, of course, that the river as it is, to make it easy of navigation would have to be improved; that is, you would have to remove the boulders or the loose impediments in the bottom here and there, but with those removed I should say that it was navigable; whether profitably or not I do not pretend to say. That probably depends on the conditions. I did observe the conditions at the cofferdam.

Q. What would you say as to the effect of the cofferdam on the natural conditions so far as you could judge by the investigation you made that day?

Objected to, because it does not appear that the witness knows what the condition of the river was before the cofferdam was built; and no proper foundation has been laid for his opinion in that matter.

Q. How far across the river will you say the cofferdam extended?

Objected to, because it does not appear that the wit-
2071 ness knows what the condition of the river was before the cofferdam was built; and no proper foundation has been laid for his opinion in that matter.

The WITNESS. Well, to the best of my recollection the cofferdam projected from one shore from two to three hundred feet.

Q. Would you say it projected half way across the river or two-thirds across or what?

Objected to, as leading.

The WITNESS. I should say about half way.

Q. So far as you are able to judge from the investigations which you made on December 28, 1910, what would you say

was the effect of the cofferdam upon the conditions as they existed prior to the erection of the cofferdam?

Objected to, because it does not appear that the witness has knowledge of the conditions that existed prior to the erection of the dam.

The WITNESS. Why, there was great contraction there and great acceleration of the current naturally.

Q. As an expert engineer, Major Meigs, if the cofferdam were removed, what would you say as to whether or not the Desplaines river would be navigable at the place where the cofferdam is now erected?

2072 Mr. SCOTT. That is objected to because it does not appear that the cofferdam would restore the river to the condition in which it was, or to the width which it was before the cofferdam was built.

The WITNESS. I think the removal of the cofferdam would make that portion of the river like the rest of it and that condition would be navigable.

Cross-Examination by Mr. Scott.

Q. You are assuming, are you not, Major Meigs, that when the cofferdam was built, it being built from the west shore, the river was not widened by blasting away the east bank.

The WITNESS. I saw no evidence of it.

Being further asked whether I am assuming that to be the fact, I would say, yes. As to whether if the bank on the east side was removed so that there is practically the same cross section there now that there was before the cofferdam was built then would I not attribute the conditions there so far as navigability is concerned to the cofferdam, I will say, one look at the cofferdam was enough to show that it was producing a great disturbance in the current.

2073 Q. If there was the same outlet for the river by reason of artificial excavation of the bank on the east that there was before the cofferdam was built, would you say that the fact that it was not navigable at that point was due to the construction of the cofferdam?

The question is objected to, on the ground that there is nothing in the evidence in this case nor in the facts in the case which justifies the assumption of the question.

The WITNESS. The projection of that cofferdam at right

angles into the stream would necessarily produce a great disturbance of the current even if the other shore were cut away. I have no knowledge of the conditions that existed at the mouth of the river before the cofferdam was built. I am unable to say how near the conditions would be returned to a state of nature by the removal of the cofferdam alone. This boat I spoke of was the Grace. She draws about two
2074 feet with coal aboard. She is never loaded. She is not used for cargo purposes at all; she carries people. She tows, she is a tow-boat. As to how many people does she carry, I would say she will carry twenty-five. With her coal and twenty-five people she would draw about 2 feet 4 inches, I should think.

I remember Treat's Island. The depth of water necessary there assuming that there were no boulders, for the Grace to pass up the channel on the left of the island I should think would be 2½ feet.

Being asked to assume that there are boulders distributed all across that channel from 2 feet to 4 and 5 feet high, then what depth of water would be necessary over these boulders for the Grace to pass up, I should think it would work over a boulder with 2½ feet of water on it. I made no examination to determine how many submerged boulders there were in the river, nor as to how much water there was over
2075 such boulders as there may have been in the river; none except looking at it. From looking at it I thought that there was a clear navigable depth of 2½ feet. The best way to determine whether there are builders there and how many and what their size is is by actual survey.

Being asked, if it should appear that both in the Treat's Island channel from the head of Treat's Island and in all the rapids and above Brandon's bridge up to Joliet there were large numbers of boulders of the sizes I have indicated, then what effect would it have upon the conclusion I have drawn as to the possibility of navigating that river with the Grace, I should say that the pilot had to be very well posted, and it might be that the boulders might be so numerous that the posting of the pilot would be of no use. That would better be determined by actual examination with the boat.
2076 Actual testing with the boat is the very finest examination you could make. I have not heard that anybody has tested the river by actual experience.

Q. Let me ask you this, Major Meigs, from your very

considerable experience with rivers, is it or is it not true that in the early settlement of a country where there is a river that is capable of navigation, the settlers have recourse to that river for bringing in themselves and their families, or for moving their produce out and their supplies back?

Objected to, as not proper cross-examination.

The WITNESS. Why naturally I would think they would.

Q. Do you know of any river in the early settlement of the western country that was capable of being used for such purposes, that was not used, before the days of railroads?

Objected to, as not proper cross-examination.

The WITNESS. I made myself a trip up one river in a flat boat, propelled by pushing which was unnavigable for a deeper boat, but we went several hundred miles up that river. It was the best route of transportation.

Q. Then it is true in your judgment, isn't it, that wherever a river was capable of being used for such purposes in the early settlement of the country it was used?

Objected to, as not proper cross-examination and as incompetent, immaterial and irrelevant.

2077 The WITNESS. I think the Indians used all the rivers.

Q. I am now talking about what the early settler did. Is it your experience that the early settlers where there was a river that could be used at all, used it?

The WITNESS. They certainly floated with boats down; they would at least do that.

Q. If you found that from the earliest history of this settlement of the Desplaines valley there is no record that any settler ever used that river for the purpose of moving into the country with his family or for moving his products out or his supplies in, what inference would you draw as to whether or not that river was capable of use for such purpose?

Objected to, as not proper cross-examination; there is absolutely nothing in the direct examination which would lead to the asking of any of these questions on cross-examination.

The WITNESS. To form a judgment of that I would have to know whether there was a better route.

Being asked to suppose there was no route except such roads as might be made across the prairies of this part of the country, following the river itself, I will say, I hardly know how

to answer that. My judgment is that they would use
2078 the best mode of transit they could find. If the road was better than the river they would use that; if the river was better than the road they would use that.

Q. Then the inference would be that a road through the prairie countries here would be better than the Desplaines river, wouldn't it?

Objected to, as not proper cross-examination.

The WITNESS. If there was absolutely no navigation on the river, I should say the road probably was better. As to my opinion that the river as I saw it in December, 1910, was capable of being used practically for the useful purposes of commerce, I would say it depends on other circumstances, on various circumstances. If the railroads were annihilated and the roads were shut up or unsafe I would guarantee to take a barge and a steamboat and go up there to Joliet.

Being asked whether I would guarantee to do it as a practical matter for ordinary purposes of commerce and continue to do it, I would say not to make money. As to even before I undertook that, wouldn't I want to make a more careful examination as to the condition of the bottom and the location and probable size of the boulders and where they were
2079 distributed with reference to the channel, I would say, no, sir, I would go there with a steamboat and find out. As to whether the Grace would climb a current of eight miles an hour; and how much greater current would she climb, I think that would be about her limit. If the currents are greater in the Desplaines river than eight miles an hour then the Grace would not go up. Another boat might. As to what means were taken upon this trip on December 28th to ascertain the velocity of the water, I would say merely visiting the various points and estimating the speed by eye. We threw blocks in. As to at how many points, well, at Treat's Island we threw blocks in. As to how great a distance did we
2080 measure, well, we walked along the shore and kept even with them for quite a distance. As to how great a distance, well enough to form an estimate of how fast the current was. As to whether or not the current varies along Treat's Island, I would say it is undoubtedly swifter in places. Being asked if I did not go the whole length of Treat's Island, I would say, well, we traveled the whole length of Treat's Island. We did not follow the blocks the whole length. We came onto Treat's Island from the left bank by the bridge and

went up to the head of Treat's Island, and then we followed down to the bridge below and went over to the right bank. That is my recollection. I think we got in the automobile and followed the road from there on down until we crossed Smith's bridge. As to what time did we leave Joliet, I would say, it was early in the afternoon. My best memory is it was soon after dinner. I should say about one o'clock. As to what time we left Chicago, I have forgotten. As to how
2081 long did we remain in Joliet, why a few minutes waiting for the automobile. We passed over four bridges in Joliet. Being asked if we stopped on those bridges I will say I think not. Being asked whether we stopped on Brandon's bridge, I will say, we stopped on one or two bridges; I don't remember which ones. I couldn't say how long we did stop on Brandon's bridge. It wasn't over five or ten minutes. As to how long we were at Treat's Island, I should think a half an hour. We went down to the shore at one point. We stopped at a farm for a moment and went down and examined the current here. We walked out to the side of the old aqueduct, the old feeder crossing just above the dam. We were there I think about fifteen minutes.

2082 As to how long we were at the dam, I should say twenty minutes. As to what time I got back to Joliet, well, if I had a time table I could tell you; but it was toward dusk. I caught a train for Fort Madison. That train went I think it was after 5 o'clock. Whatever examination I made of the river was made between the time when I started first to Joliet after dinner and when I got back to the train after 5 o'clock.

As to how far up the river could I see when we were on Brandon's bridge, I don't recollect. Being asked if I made any examination of the condition of the river below McDonough street bridge in Joliet to Brandon's bridge except standing on Brandon's bridge and looking up, I would say, nothing but by looking down on it. I believe the river makes a curve about Brandon's bridge. I am not able to say how far I could see the surface of the river.

Being asked whether it would have any effect upon my judgment as to my ability to take a boat up there whether I did or did not see the stretch between Brandon's bridge
2083 and Joliet, I will say, no, it would not, because a man gets an idea of the general character of a river unless he sees a rapid somewhere, why he thinks it is about the same all along.

Being asked if I then assumed it was about the same all along, I would say, yes, in stretches.

Speaking of the Keokuk Rapids—the lower water of 1864, the depth in the improved channel, I don't believe was over 12 inches, practically 12 inches. As to how often that has occurred, well, it occurred in 1864; it occurred in 1892; it occurred in 1910; and it occurred in 1905, I think. Last year it continued for about five months. Not at extreme low water, but at too low water for navigation. Too low water for navigation in that channel is a stage of about 4 feet on the gauge at Keokuk; that would give a depth of about 3 feet. In
2084 1864 it continued for several months. In 1894, it was, I think, two or three months.

Being asked if I mean that the low water continued for that many months or that navigation in the channel was suspended, I would say the water was too low to render the rapids navigable. The stage of the water during these periods was below one foot on the gauge; in the channel, well, 1½ to 2 feet. It might have been 2 feet deep in the channel for a month.

Being asked whether during the rest of the period when navigation was suspended, how deep it was, I would say from 2 to 2½ feet. There are gauge readings that cover all those. They are records. I am speaking merely from recollection.

Being asked whether in order that the channel in those rapids should be practically navigated a depth of something like 4 feet is necessary, I would say, it must be about
2085 that to make it safe because nobody knows all the boulders and the danger from boulders is the danger of striking the bottom of the boat on them. The danger would be the wrecking of the boat by striking the boat on them.

Q. You say that prior to the improvement of those rapids there was at low water no navigation. With what meaning did you use the word low water in that statement, indicating what depth?

The WITNESS. Speaking of navigation, I mean steamboat navigation. No steamboat, no large steamboat could get through those rapids on less than 3 feet. Some were dragged over, I guess, on less than 3 feet. I think maybe a couple of inches less than 3 feet; they might have been dragged over or forced over down stream. No up stream boat could do it. As to extreme low water in the Des Moines river, I will say that was during the year 1909. I don't know what was extreme low water in that year.

Q. You said if I understood you correctly it could
2086 be waded half knee deep, was that right?

The WITNESS. Many places—not when I navigated it. I navigated it in 1909. The depths I then found were from 4 to 11 feet. The slope of that river is about a foot and a half to the mile average. The character of its bed below Ottumwa is all rock; above Ottumwa it is gravel and sand and rock. In the early days a great many steamboats made use of that river. It was first improved for navigation at about the outbreak of the war, they had a project for improving the river by locks and dams. They built five as far up as Ottumwa, but those have all disappeared. Prior to the war steamboats did operate on that river.

Being asked whether I spoke of the low water being 360 cubic feet per second, I will say, there are records—I think last year was the record year for prolonged and extreme low water. That was the year when this 360 cubic feet was recorded. That continued five or six months; not extreme low
water, but very low water. Extreme low water would
2087 probably continue say three months. As to what depths
of water would the extreme low water have given in the river, I will say at the mouth of the river I attempted to go up in a skiff that drew about 28 inches and that was rather a deeper place; it would not go. I should say 18 inches. The ordinary low water in that river not in exceptional years I think is about 2½ or 3 feet. That continues sometimes for two or three months. This steamboat navigation in the days when there was steamboat navigation on that river was possible sometimes for five months, sometimes for six; sometimes not at all. The months when it was five or six months in the year were I would say from May to April, probably five months afterwards, to September. The low water period is usually in the middle of September. The period when the river was navigable for such boats recurred with reasonable regularity.

Being asked if I spoke of going over the Des Moines rapids at high water and not going through the canal, going down
stream, and what is high water on those rapids, I will
2088 say it is 11 feet at the upper end of the rapids and it is almost 20 feet at the lower end.

Being asked if boats go up the rapids now, I would say, sometimes. Well, a boat in a hurry, if they are in a hurry and they don't mind burning the coal, they go outside. That

would be in periods of high water. At no medium stage is that attempted. A medium stage on that rapids I call 5 feet at the upper end of the canal. I went up the Des Moines for the purpose of ascertaining and reporting whether it was navigable, and I reported that a stream that had been used as that had for steamboats for purposes of navigation undoubtedly must be a navigable stream.

Q. Now I ask you to assume a river 50 miles long, or a stretch of the river of 50 miles from its mouth up stream, 40 per cent. of which is in rapids over a rock bed; assume that the stage of the river in flood was as you saw the river on the 28th of December, that is in flood in a state of nature before any artificial additions to it, and that the ordinary stages of water were less than 15 inches passing through
2089 boulders over the rapids, what would you say as to whether or not that was a navigable stream?

Objected to.

The WITNESS. That is what they call a hypothetical question?

COUNSEL FOR DEFENDANT. That is what it is.

Objected to as not cross-examination, and further on the ground that it has hypotheses in it which are not founded on any evidence in the record in this case.

The WITNESS. My opinion is that adventurous spirits would use it.

Being asked whether my definition of a navigable stream is one which adventurous spirits would use, I will say, sure. Being further asked whether any stream which an adventurous spirit taking his life in his hands would use would be a navigable stream, I would say it is done every day.

Q. Is that your definition of a navigable stream?

Objected to.

The WITNESS. It depends on the definition of navigable. As to what is my definition of a navigable stream, I will say, navigability depends upon a great many concomitant circumstances. If it is the line of least resistance men will take desperate chances to use a river.

Q. Let me ask you another question: Assuming such
2090 a stream as I have mentioned which for 50 miles from its mouth up stream is composed of 40 per cent. rapids over a rock bed, filled with boulders, the ordinary stages of the water during the period of navigation, if there were navigation, being less than 15 inches passing around and over

the boulders, would you say that that was a navigable stream for useful purposes of commerce?

Objected to, as not proper cross-examination, and on the further ground that there has been no foundation in the evidence for the hypothesis asked in the question.

The WITNESS. It might be. If there was no better way of going. That is what we term as navigability. As to whether it depends upon the depth of the water or the number of boulders or how much of it is rapids, I would say you must have some water, but a stout boat with a thick bottom loaded with light freights can navigate such a river as that, down stream or up stream without regard to the slope of the rapids or the number of boulders or the size of the boulders; they will get up almost anything if there is water enough to
2091 float the boat. As to how much water would that require, I will say a boat drawing six inches could be made to float a large cargo down stream. As to how about up stream, I would say, get out a rope and tow her up. How much of a cargo a boat drawing six inches would carry on that kind of a stream would depend entirely on the beam and the length.

Assuming such a boat as I had in mind when I said this could be navigated by a boat drawing six inches, the kind of
2092 a boat I had in mind in that answer, I will say I had in mind such a boat as we use on the Crow Wing river in transporting our camping equipage. That was a boat about forty feet long, and if I recollect right, about ten feet wide. The kind of a load we carried on it was camping equipage. I think it would draw six inches. I don't think much more.

Being asked whether that matter could be definitely figured, I will say you could cipher it out. Being further asked to cipher it out and tell what that boat as I have described it, would draw, I will say I have built a great many flat boats with decks, I think 20 feet wide and 100 feet long, for instance, built for carrying rock, and those boats when they come out draw about six to nine inches light, and with decks on them. The deck is quite heavy; the deck would make them draw two or three inches more. This boat I speak of was an open boat, and she had planks along the side to
2093 form a runway, and the method of operation was for four men, divided into two gangs, one man walking down the plank with his shoulder to a pole while the other man

was going up and getting his pole ready. That took turns; they just walked back and forth, and shoved that boat upstream for a hundred miles. That carried our equipage. Our crew and the equipage I think weighed possibly a ton.

Being asked to tell what it would draw, built in the manner I have described, I will say I will figure it 40 feet long, two feet gunwales and two inch bottom (after figuring). My figures give the weight of the boat equal to a draught of three inches, which would leave quite a margin for the load. I figure the boat would weigh about 10,000 pounds, which would be the displacement, and if that is spread over 800 square feet—no, I am wrong; it is 40 feet long, isn't it? That is where I am wrong. Let me cipher this again (after figuring). My figures for the boat alone are 4.4 inches. I took the wood as weighing 50 pounds to the cubic foot. I took the gun-
2094 wales as two feet deep; the length of the gunwales as 40 feet; the area of bottom as 400 square feet—wait a minute, I will make a correction; here I take the water as fifty; I ought to have taken the water as 63 pounds. That makes 4.6 inches. Being asked whether I have stated all of the factors that I used in arriving at my conclusion, I would say, yes, the weight of water 63 pounds. As to how much I add for my crew and my equipage—well—oh, about ten men. As to what difference in depth it would make—well, I will figure that. A thousand pounds for the equipage, that is a mere guess; but ten men at 150 pounds would be 1,500 pounds, wouldn't it, that would be 2,500 pounds. (After figuring.) It is a little over an inch, about two inches. That would make a total of about 4.4 plus about one and a half, would just bring it about 6 inches. As to how much water would be required in addition to the mere draught of the boat, I will say I figured something over an inch and an inch and a half I have allowed that, indeed I have. That makes the total draught as I have it here 4.6 plus 1.2; that
2095 would be 5.8 inches. As to what do I allow to float the boat, I will say to float the boat would be .37 of a foot. Being asked if I take simply the draught as given there wouldn't the boat be on the bottom of the river, I will say the draught is exactly equal to the displacement, to the weight of the water she displaces. Now, if you can weigh the boat you can tell how much water she displaces because it will weigh just that amount. The amount she will displace depends upon the square feet in her bottom if it is a square boat. She dis-

places so many pounds for every inch she goes down. What I have endeavored is to weigh one against the other.

Being asked whether I have given all the depth of water that is required in the river to operate such a boat, I will say, to float it, yes; it will have to have some depth
2096 to navigate it—an inch more. That could be over the boulders—an inch over the boulders. If she didn't she would hit, but she could slide over boulders that would have less than the draught of the boat on.

Q. Now, you have taken your time and I am asking this because your time does not appear in the record, and have figured this out and made your calculations and that is your calculation, is it?

The WITNESS. Yes, but you see you come at me with these things and in looking at my figures now I have possibly—no, I have made no mistake. I have figured the draught of the boat alone at .37 of a foot; and the draught of the load as one-tenth of a foot. There is 4.7 of a foot. That multiplied by twelve for inches, would be 5.6 inches.

Q. If I understand you correctly, you consider any stream navigable over which a boat such as you have described can be forced, is that correct?

The WITNESS. I will say yes, it is navigable, with proper boats. As to whether when I was sent up the Des Moines river to report to the government whether that river was navigable, I understood that I was to test its navigability by any such definition as I have now given, I will say, no, I was told to make an exploration merely.

2097 It is true under the definition I have now given all rivers are navigable, more or less, unless there is a vertical fall.

Q. Can't you take the kind of a boat you have described upon a vertical fall?

Objected to, as not proper cross-examination.

The WITNESS. No, that is a case of portage.

COUNSEL FOR GOVERNMENT. I move to strike out the question and answer.

Being asked if according to my definition any brook up or down which a boat drawing six inches of water can be forced is a navigable stream, I would say yes, under certain conditions. As to how can its navigability depend upon conditions and what are those conditions, I would say, navigability depends upon necessity and surrounding circumstances.

A stream that you call a navigable stream now, or was a navigable stream like the Des Moines, you say it is unnavigable now because it is not profitably navigable; because the conditions have changed. But in the early settlement of the country, why, men would take great hazards to get their stuff up and down these streams when there was no better road, when it was a trackless wilderness. They could navigate and would navigate probably streams that we would consider now utterly unnavigable.

2098 Q. In your judgment, is such a river as I described in my hypothetical question capable of being used for purposes of profitable navigation in the way in which commerce is usually carried on today?

The WITNESS. No.

Objected to, unless you show the elements of your hypothetical question.

COUNSEL FOR DEFENDANT. I do not intend to repeat them as long as it appears that the witness has them in mind and his answer indicates that he has.

Being asked if it would affect my judgment as to the navigability of such a river as I have assumed, if it appears that by the gauge readings it practically runs dry during the summer months of each year, I will say, it would not. It would still be a navigable stream. Shall I say why?

COUNSEL FOR GOVERNMENT. Yes, you may.

COUNSEL FOR DEFENDANT. No—

The WITNESS. May I say that?

COUNSEL FOR GOVERNMENT. In one moment I will give you that opportunity.

Cross-Examination Continued.

Being asked if it would affect my judgment as to its being navigable if it appeared that in every year there were consecutive months in which there was no discharge in that

2099 river, I would say, not if it was shown that it had at flood stages a volume that was sufficient to carry commerce. As to whether it would affect my judgment if it appeared that those flood stages last only two or three weeks in the spring and sometimes only two or three days, I will say, we are dealing now with hypothetical questions and I would answer that, no, it would make no difference.

Q. Would it make any difference at all in your judgment

as to whether such a stream was or was not navigable, that the flood conditions did not recur with such regularity that it could be reasonably anticipated at any time that there would be such a stage?

The question is objected to, as not proper cross-examination; and further on the ground that all these questions are based on hypotheses not founded upon the evidence in the case; and I now move to strike out all these questions referring to this hypothetical condition in the Desplaines river which has not been stated.

The WITNESS. Suppose I answer no to that; I am in doubt whether I am voting yes or no.

2100 COUNSEL FOR DEFENDANT. If you answered no you would mean it would not affect your judgment as to the navigability of the stream.

The WITNESS. No, it would not affect my judgment under these hypothetical conditions.

Being asked, whether it is my judgment that a stream is navigable which would float a hunter's or fisherman's boat in the early days of the settlement of the country, I would say if it would float a fisherman's boat it would float a trader's boat, and I would then consider it navigable.

Q. And it is in the light of that understanding of navigability that you have been giving your answers, is it?

The WITNESS. Yes, but I would like to explain what I mean.

Q. Just one question more and I will ask you to explain.

That is objected to, on the ground that the witness has asked leave to explain his answers and counsel for the defendant continues to postpone that explanation which the witness desires to make.

COUNSEL FOR DEFENDANT. With the assurance that the witness will have ample opportunity all that he desires.

The WITNESS. Being asked whether it is my judgment that such a river as you have assumed in the questions asked me is capable of being used for the purposes of useful com-

2101 merce in the way in which commerce is usually carried on, at the present time, I would say no.

Being asked whether it as I saw it on the 28th of December, I should say it was not profitable under present conditions.

As to whether it is capable of being used for useful purposes of commerce would say would not be profitable under present conditions.

COUNSEL FOR DEFENDANT. Now, Major, I would be glad to have you make any explanation that you care to.

The WITNESS. In dealing with this question of navigability, I have had in mind the exigencies of early settlement. Not in competition with railroads or with modern methods of travel, but only such as the early settlers of the county would have been forced to use. For instance, when the country was covered with dense woods through which you could get nothing, or when the land was an impassable swamp from wet, they would naturally take to the rivers and use them. I call that navigability, if they can get up and down with profitable loads.

Q. Let me ask you: If it appeared that in the times
2102 of spring when the land adjoining the river was largely overflowed and swampy that the river was never used in a single instance by any of the settlers in the Desplaines river valley, so far as the evidence shows, would or would that not be evidence to your mind that it was not a navigable stream?

The question is objected to, on the ground that it is not proper cross-examination, and on the further ground that there is not foundation in the evidence for the hypothesis assumed by counsel.

The WITNESS. I would want to know whether anybody had tried it.

Q. Would not the fact that nobody had tried it, be significant under such conditions as were assumed in my last question?

The question is objected to, on the ground that it is not proper cross-examination; and, on the further ground that there is no foundation in the evidence for the hypothesis assumed by counsel.

The WITNESS. It would be significant, yes. It would be significant that it was difficult. It would have no greater significance than that.

Q. I have gathered from what you said that men would take all kinds of chances and all difficulties when the conditions were such as I have indicated, to use streams if it
2103 were possible to use them. Do I misunderstand you?

The WITNESS. No, you don't misunderstand me there.

Q. I understood you correctly, did I?

The WITNESS. Yes, that is right.

Q. If the conditions are such as I have assumed on land, and it appears that nobody tried to use it or did use it, what would be the significance in your judgment?

Objected to, on the ground that it is not proper cross-

examination and on the further ground that there is no foundation in the evidence on the hypothesis assumed by counsel.

The WITNESS. Well, I would want to know whether they could get to the river.

Q. Assume that they forded the river on those very trips and assume that their settlements lay along the banks of the river, and that the river led from the point where they lived to their destination, and they did not use it; what would be the significance?

The question is objected to, on the ground it is not proper cross-examination, and on the further ground that there is no foundation in the evidence for the hypothesis assumed by counsel.

2104 The WITNESS. It would be very strong argument against the navigability of the river.

Q. Suppose that the only market that the people living along this river had was at Chicago, and that there were no railroads, and that in the spring of the year when the country was soft, there is no evidence that any settler living along its banks ever came to Chicago by that river, would it not be the logical conclusion that the river is not navigable, and that is the reason they did not use it?

The question is objected to, on the ground it is not proper cross-examination, and on the further ground that there is no foundation in the evidence for the hypothesis assumed by counsel.

The WITNESS. I think so. That is only common sense.

COUNSEL FOR GOVERNMENT. Without waiving the objection which I make to the competency of this evidence on cross-examination, I now move to strike out all the questions and answers having to do with the hypothesis put by counsel for the defendant in regard to the early settlement of the country; without waiving that motion I will, however, ask the following questions:

Re-direct Examination by Mr. Cressy.

Q. If it should appear, Major Meigs, from the evi-
2105 dence in this case, that the Desplaines river in a state of nature, that is prior to 1848, was used by the early travelers for the purpose of transporting furs and other commodities up and down, would that have any bearing in determining your answers to the hypothetical question put to you

by counsel for the defendant on the hypothesis of there being 15 inches of water in the Desplaines river?

That is objected to, on the ground that his answer to another and wholly different question can have no bearing—his answer to the former question having no relation to this question of the Counsel for the United States, and because the question does not identify so that it can be determined what hypothetical question counsel for the United States refers to.

COUNSEL FOR GOVERNMENT. I asked counsel for the defendant several times to outline his hypothetical questions so as to enable us to determine exactly what that question was. Counsel refused to do that.

COUNSEL FOR DEFENDANT. On the ground that the witness understood and answered the question, and if the witness understands the question that is all that is necessary.

COUNSEL FOR GOVERNMENT. I will ask the witness as to whether he understands my interpretation of the hypothetical questions put by counsel for the defendant, and if he is able to answer the question as now put, to do so.

2106 COUNSEL FOR DEFENDANT. I object to the question as not being intelligible.

The WITNESS. My understanding of the question is, as you put it, that you ask if there was navigation proved by history, would that influence my opinion as to the navigability of the river, in a state of nature, and I would say it would.

Q. If it were shown by the testimony of three historical experts who had examined between twenty and eighty-five references to the use of the Desplaines river, and from that examination gave their opinion as historical experts that the Desplaines was in a state of nature actually used for certain portions of each year for the purpose of carrying on trade and commerce, would you say as an expert engineer, that the Desplaines river was a navigable river in a state of nature?

Objected to, as incompetent, immaterial and irrelevant, and for the further reason that you cannot prove the navigability of a river by having certain historians draw deductions from data, give their conclusions and then ask another witness what conclusion he would draw from the conclusion of the historian.

The WITNESS. I would say yes.

2107 Being asked whether in the examination of the Desplaines river which I made on December 28, 1910, I found any evidence of there being bowlders at any of the points at

which I inspected the river; such bowlders being an interference with the navigability of the river, I will say, I didn't see any.

Q. Now, one question which I omitted to ask you on direct examination, which I will now ask you, and that is in reference to the boats which navigated the Mississippi river. What can you say as to the number of boats which navigate the Mississippi river or make use of the Des Moines Rapids canal, which draw three feet of water or less?

Objected to, as incompetent, immaterial and as having such a margin as to the draught of the water as to be of no consequence.

Q. How many boats in an ordinary year pass up and down the Mississippi river, Major?

Objected to, as immaterial, irrelevant and incompetent.

The WITNESS. Oh, sometimes two thousand, three thousand.

Being asked if I have had occasion to investigate as to how much water those boats draw, I will say yes.

2108 Q. How many pass up in the course of a year drawing three feet of water or less?

Objected to, as incompetent, immaterial and irrelevant and as not indicating with sufficient definiteness the draught of the boat so as to be of any value.

The WITNESS. The majority of boats draw three feet; some of them, the rare boats, draw two and a half feet. Two and a half feet is the average of the lighter tow boats.

Q. About how many boats draw two and a half feet of water that pass up and down the Mississippi river in the course of a year?

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. Without the record, I should say perhaps a thousand. I am familiar with a boat called the Centennial.

Q. What is the size of that boat?

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. The Centennial? She was about 325 feet long, and about, I should say, 35 foot beam, drew about three to three and a half feet of water.

As to what she carried on three and a half feet of water, I would say, she would carry, I suppose, 100 tons.

2109 Q. What do the boats drawing two and a half feet of water—what are the size of those boats in general?

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. They would be about 26 foot beam by 120 to 140 feet long. They don't load them at all; they are tow boats.

There are some small packets often smaller than that, that carry a load of five or ten tons.

Q. Suppose, Major Meigs, that extending from the City of Joliet to the City of Chicago, the Sanitary District channel with a depth of nine feet and upwards, connecting at Dam No. 1 in Joliet with the Desplaines river; supposing that a lock were cut in that dam to enable the passage of boats from the Sanitary District channel into the Desplaines river, and supposing that the Illinois river from the mouth of the Desplaines to the Mississippi were a navigable river, what would you say as to whether or not the Desplaines river is capable of profitable use for trade and commerce?

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. Profitable use?

Q. Yes.

2110 The WITNESS. You mean to make money as a business proposition or merely as a physical proposition?

Q. Well, you may answer it in both senses.

The WITNESS. As a business proposition I would say it was too shallow. As a physical proposition I would say it was possible in its present condition.

Q. What would have to be done to the Desplaines river to render it profitable?

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. There would have to be improvement by slack water navigation. Not slack water navigation, but by slack water.

Q. Would you say as an expert engineer that the Desplaines river was susceptible of such improvement?

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. Undoubtedly.

Re-cross Examination by Mr. Scott.

Being asked, if the Desplaines as I saw it in December last was not capable of carrying useful commerce in the ordinary way in which commerce is carried by water and would it be still less capable of carrying useful commerce

2111 with less water flowing in the river, I would say, naturally.

Being asked whether I said I didn't see any boulders that would obstruct navigation in the Desplaines river, and whether I saw any boulders at all in it, I will say, yes, I

saw some down toward the mouth. I think there were some sticking out of the water along shore at the head of Treat's Island. I saw none in the channel. The character of the surface of the water was turbulent. That would indicate changes of slope. As to whether the surface of the water would be affected at all by the existence of boulders underneath that surface, I would say more or less. Being asked if there was any indication on the surface of the water that there were boulders underneath, I would say there were waves. As to what it would indicate, I would say, not
2112 necessarily boulders. It might have been boulders; it meant some obstructions.

Being asked if I said the same conditions existed above Brandon's bridge, I will say my recollection is that above Brandon's bridge the current was more uniform; meaning by that, alike everywhere. My recollection is that it was swift there, but more or less uniform in appearance.

Being asked if I did not see the river below McDonough street, about midway between that and Brandon's bridge, I would say, I don't know whether we visited that place or not.

Being asked whether I saw any boulders appearing above the water in the neighborhood of Treat's Island, I will say I think along the shore there were some. I don't recollect that I saw any out in the stream. Being asked if I know whether or not there existed boulders in the channel at
2113 Treat's Island, from two or five feet high, I will say I have no knowledge of them.

Q. Do you know, as a matter of fact, that boulders of that character are scattered over all the rapids of the Desplaines river below Joliet?

Objected to, on the ground that the witness has already answered that question.

The WITNESS. I think it likely.

2114

D. H. DUGAN, heretofore called as a witness on behalf of the Government, resumed the stand.

Direct Examination by Mr. Cressy.

Being asked whether I have examined the gauge records of the Sanitary District for December 28, 1910, prior to com-

ing in here this morning, from the official records, I will say, yes, I have. As to whether I have copied off of the records of the Sanitary District the readings which I am now
2115 about to give, I will say, yes, I have. At Dam No. 1, the upper level, the reading was 2.35 feet on the gauge; at the lower level the gauge read 1.3; Brandon's bridge, .7; Alexander's at the mouth of Jackson creek, .9. At the site of the old Kankakee Feeder Aqueduct, 1.08; and at the E. J. & E. bridge, Devine, 2.2. I will give you the elevation of the water at the same points referred to Memphis datum.
2116 Dam No. 1, the upper level, 545.37; lower level, 534.28; Brandon't bridge, 514.22; Alexander's or the mouth of Jackson creek, 503.94; and at the aqueduct, 499.69; at the E. J. & E. bridge, 493.7. As to whether I have ascertained what depths in the thalweg or middle of the stream would be produced by the readings I have given at these various points, I would say, I have, yes. I will give the result of any computation in reference to that point. On the crest of Dam No. 1 there was .8 of a foot of water. Just below the dam the water was 4.28 feet. At Brandon's bridge 5.2 feet. At the mouth of Jackson creek 9.9 feet. At the site of the aqueduct, 9.7; and at the E. J. & E. bridge, 12.7 feet. There is no gauge right at the head of Treat's Island. I am able by means of the gauge readings which I have produced and by means of the profile, to approximate what the depth of water would be at the head of Treat's Island on December 28th. It would be about three and a half feet at the head of Treat's Island on that date. There is no gauge read at the foot of Treat's Island. I am able to approximate
2117 from my gauge reading and profile of the Sanitary District, what the depths of the water would be, at the foot of Treat's Island on that day; it would be about four feet deep there. As to whether I have examined the records of the Sanitary District and made copies of the gauge readings for August 13, 1909, I will say, yes. For the August 13th stage I might explain that my memorandum here simply gives the elevation of the water. The actual gauge readings I did not copy except in so far as it is necessary to obtain the elevation of the water.
2118 Being asked if I have the gauge readings, copies of the official gauge readings of the Sanitary District for August 13, 1909. I will say, yes, they are as follows: At the upper level of Dam No. 1 the gauge reading was 2.3. At the

lower level 1.2. At Brandon's bridge, 1.8; at Alexander's, 2.4; at the Kankakee aqueduct, 3.4; at the E. J. & E. bridge, 3.6. The elevation of the water at those various points referred to Memphis datum, these are equivalent to the following elevations: Upper level Dam No. 1, 545.32; lower level of Dam No. 1, 534.78; at Brandon's bridge, 515.42; at Alexander's 505.44; at the Kankakee aqueduct, 501.29; and
2119 at the E. J. & E. bridge, 494.81. The accepted difference between the Memphis datum and the Chicago datum is 587.04. That is, zero Chicago datum is plus 587.40 Memphis datum. From the figures that I have given by the use of this accepted difference, there would be no difficulty to determine what the datum of these points was, according to Chicago datum. The depths of water in the thalweg or middle of the stream at these various points where I have given the gauge readings and elevation of the water would be, on the crest of Dam No. 1 the depth of the water was .7 of a foot. Just below the dam the water was about 4.8 feet; at Brandon's bridge, 6.4 feet; at the mouth of Jackson's creek, 11.4; above the Kankakee aqueduct, 11.3; and at the E. J. & E. bridge, 13.8. I testified that there were no gauge readings made either at the head or foot of Treat's Island, on August 13, 1909, so far as our records were concerned. I have approximated what the depth of the water would be at the head and foot of Treat's Island on August 13, 1909; approximately that depth of water would be, basing my
2120 answer upon the gauge readings and upon the profile of the Sanitary District at about five feet deep at the head of Treat's Island. And at the foot about 5½ feet deep. As to what determines the variation in the water on the crest of dam No. 1, I would say it varies with respect to the natural stage of the river, and also with respect to the amount of the water taken through the power plant there situated, it is effected by the water that is drawn off through the power plant.

2121 *Cross-Examination by Mr. Scott.*

Being asked if there is a variation in the height of the water at dam No. 1, by reason of the operation of the power plant, and whether there is also a variation in the elevation below dam No. 1, I would not say that the variation below the dam would amount to very much. It depends, of course,

upon where the tail race empties. As to what discharge in cubic feet per minute the gauge readings represented which I have stated occurred on the 28th of December, I will say I don't know the amount of the discharge. I made no computation. That is not a material factor in determining elevations; the depths given at the head of Treat's Island are dependent upon the height of the water on that day at the mouth of Jackson creek, and upon the slope between that point and the head of Treat's Island as determined from the low water line of 1901, and upon the depths shown at the
2122 head of Treat's Island during the low water of 1901.

The computation by which I arrived at the depths on that particular day would simply mean taking the difference between the low water of 1901, at the mouth of Jackson creek, and at the head of Treat's Island and adding that to the stage of water at the mouth of Jackson creek, and to the stage of water at the head of Treat's Island; and the Government survey of 1902, and 1904, will show the depth of the water during the low water of 1901, at the stage of Treat's Island. Taking the difference between the stage of water on the 28th as shown by that slope, and the low water of 1901, and adding that to the sounding as shown on the maps of the Government survey, the depth of the water would be obtained for the day. The elevation of the water on December 28th at the mouth of Jackson creek, was 503.94; the elevation of the low water of 1901 at the mouth of Jackson creek, was practically 502.4; at the head of Treat's Island the ele-
2123 vation of the low water of 1901, was 512.6. That represents a slope then, between the mouth of Jackson creek, and head of Treat's Island of 10.2 feet. Adding this 10.2 feet to the elevation of the water on December 28th, at the mouth of Jackson's creek, we obtained 514.14 feet as the approximate elevation of the water at the head of Treat's Island on that same day. The soundings at the head of Treat's Island, show the bed of the river at that point to be at an elevation of practically about 509.3 feet, giving the depth of water as practically 5 feet. These several gauge readings were taken on December 28th, in the morning between the hours of six and eight. The elevation of the water in any river depends upon the amount of water flowing. Being asked if it makes any difference in the elevation of the Desplaines river whether there was 250,000 cubic feet per minute moving in it or 400,000 I think it would. It would de-

pend upon the locality; it would depend upon the slope.

2124 Being asked whether there is any place in the Desplaines river below Joliet, where a variation in that amount in the volume of water would not make a material difference, I do not recall any; no, I don't know of any. I do not know what the variation in a given day is in the amount of water that is discharged into the lower Desplaines below dam No. 1. I do not know anything about the variations in amounts due to the operation of the power plant. Being asked if I made all of my calculations upon the theory that the river would be at a certain elevation at the times when these particular gauge readings were made, and if they would continue throughout the day the same as they were at the time these particular gauge readings were taken, I will say, no, I have not assumed anything like that. Being asked if I mean to be understood that I have any data upon which I have based my testimony as to the elevations except those gauge readings, I would say I could give the evening readings, if you liked it.

2125 The testimony I have already given is based upon the morning readings. Being asked if on anything else, I would say of course it is based upon the elevation of the zero of the gauges; indirectly upon some other features, but directly upon the morning gauge readings. That would indicate to me that at that hour as the gauge then read, the water stood at the points I have mentioned at the depths I have mentioned. As to whether there were different depths during the remaining 23 hours of the day, I will venture to say that there were different depths; the river is very seldom at a constant elevation for any given length of time. Being asked if in this instance it would not be the variations which would obtain in a river in a state of nature; but would be the variations also caused by the operation of the power plants, I would say if any variations of flow were made at Lockport, they would affect the river.

2126 Being asked if in all my knowledge of the river I have known anything of those variations caused by the power plant, I will say I know that their flow is not constant.

Re-direct Examination by Mr. Cressy.

The Witness. I have here the evening gauge readings for December 28, 1910. The evening gauge readings on that day, at the upper level of dam No. 1, read 2.25; at the

lower level, 1.15; Brandon's bridge, 1.2; at Alexander's, 1.1; at the Aqueduct, 2.5; and at the E. J. & E. bridge, 2.2; the same as the morning reading. The evening and morning readings were the only readings that were made on December 28, 1910, I have any knowledge of.

Q. I will ask you as to whether the evening readings with the exception of the reading on the crest of dam No. 1, show any material change from the morning readings?

I object, that the figures will speak for themselves.

2127 The WITNESS. No, sir; I would not consider the difference material, it varies, of course, from nothing to a maximum of 5/10 of a foot above what the morning reading I gave.

Q. You may state, basing your answer upon your experience as supervisor of the gauge records of the Sanitary District, as to what stage of water would be represented by the readings that you have given for December 28, 1910; would that be a high stage, a low stage, or a medium stage?

Objected to as incompetent, immaterial and irrelevant, and as calling for a conclusion upon data which is not in the evidence.

The WITNESS. It would be a low stage of water.

Referring to August 13, 1909, I have the evening readings on that date; I can give those. At the upper level of dam No. 1, 1.15; at the lower level, 2.25; at Brandon's bridge, 2.0; at Alexander's, 3.2; at the Kankakee aqueduct, 3.9; and at the E. J. & E. bridge, 4.8.

Q. With the exception of the gauge reading at dam No. 1, do those readings show any material change from the morning readings that you gave for the same date?

Objected to as incompetent and immaterial and as irrelevant; and as calling for a conclusion upon data which is not in the evidence.

The WITNESS. The only one that varies to any great extent is one at the E. J. & E. bridge, where the water was 1.2
2128 feet higher in the evening than in the morning. The E. J. & E. bridge is not in the Desplaines river; it is in the Illinois below the Desplaines.

Q. What was the stage of water in the river on August 13, 1909, gauging your answer upon your knowledge of the gauge reading?

Objected to as incompetent, immaterial and irrelevant, and as calling for a conclusion upon data which is not in the evidence.

The WITNESS. August 13th, based upon the morning reading, the depths at the various points are, dam No. 1, upper level, 7/10; just below the dam, 4.8.

COUNSEL FOR GOVERNMENT. Just a moment, I don't think your answer is responsive to the question, but if you have the elevations there I will allow you to give them. I will withdraw my question and ask this: what are the elevations of water as shown by the gauge readings on the evening of August 13, 1909?

Objected to as incompetent, immaterial and irrelevant, and as calling for a conclusion upon data which is not in the evidence.

2129 The WITNESS. I will give these to you in Chicago datum unless you want me to make a reduction. I have them in that datum here.

COUNSEL FOR GOVERNMENT. You have no objection to these being given on Chicago datum? He has computed them on Chicago datum.

COUNSEL FOR DEFENDANT. No.

The WITNESS. At the upper level of dam No. 1, the evening reading shows an elevation of minus 41.77; the lower level, minus 52.31; at Brandon's bridge, minus 71.52; at Alexander's minus 80.8; at the Kankakee aqueduct, minus 85.25; at the E. J. & E. bridge, minus 91.03.

Q. Now, you may state as to whether the stage of water in the Desplaines river on the evening of August 13, 1909, was at a high, medium or low stage.

Objected to as incompetent, immaterial and irrelevant, and as calling for a conclusion upon data which is not in the evidence.

The WITNESS. At a low stage of water, I will say with reference to both of those dates that it was a low stage of water. We keep these gauge readings among the permanent records of the Sanitary District. They are kept for

2130 each day. Morning reading and the evening reading. They date back to various dates. The gauges were not established all at the same time. The readings on this particular stretch of the river date back to, I think, 1902, at Alexander's. At some time in 1903, that gauge was established as a permanent gauge and has been read continuously since that time; and the others were established at later dates. Being asked if I can explain why, on August 13, 1909, there is practically no change from the gauge readings in the morn-

ing with the exception of the gauge reading at the E. J. & E. Railroad bridge, I would say to my mind that would be due to the influence of the Kankakee river; the flow probably increased during the day in that river. A high state of water would be around the mouth of the Kankakee river say, or at the mouth of the Desplaines river at its junction with the Kankakee, it would have to be in the neighborhood of eight to ten feet above the stages I have given. A medium stage would be between high and low, but a medium stage
2131 would hardly be midway between because the high waters are of very short duration as a rule, and the medium stage, the mean of all the readings, would be somewhat less than midway between possibly one-third. When I say low stage, I meant to say during the most of the time the water was higher. Being asked as to how much of the time, I would say I have not examined the gauge records to see, but these look like very low waters to me, and I think it would be safe to say that the water would be above this stage.

COUNSEL FOR DEFENDANT. Move to strike out the answer as not responsive to the question.

The WITNESS. For a longer period of the year than it would be below.

COUNSEL FOR DEFENDANT. Move to strike out the answer as not responsive to the question, and as not purporting to be based upon the records themselves.

2132 *Re-cross Examination by Mr. Scott.*

The WITNESS. These gauge records are in my immediate charge. That means that the gauge readings as taken come to our office and the disposition of them after they get there is up to me, as it were. Being asked what that means, if I put them in the files, or that I perform some duties as an engineer with reference to them, I would say there are various things done with them. They are tabulated. My duty is to superintend the work and see that it is done properly and executed in due form, and see that there are no errors and to check up the work generally. Being asked if I
2133 check up the records that these other men make by the original cards, I will say sometimes I do. How often I do it depends. When I am called upon to testify to readings of this character, of course, I consider it my duty to inform myself on those matters and go to the trouble of check-

ing up those things. In my testimony in this case I have taken these readings from the original postal cards. As to what other duty I have to perform with reference to those gauge readings, I will say the gauge readings are taken, of course, upon a staff, or gauge, which is set in the river, and from time to time it becomes necessary to reset those gauges, and to determine the elevation of the zero, and that work is in my charge, I see that that is done. Being asked to please confine myself to what I do with the gauge records that are taken, and give all the duties that I have with reference to them, I would say that is pertinent to the records that are taken, because if the gauge is not set the records cannot be taken. Assuming the gauge is properly set
2134 and the records properly taken. I see that they are kept. I see that they are filed properly. I don't know that I can specify anything else, except anything that is required that is up to me. As to whether anything that is required indicates anything to the court, because he don't know what is required, I would say he has imagination just as well as I have and sometimes I have to work by imagination.

Being asked if I have to make any computations from those records at all, and within the line of my duty, I would say, yes, just computations as these, for instance. I don't know that I can specify anything particular. Being asked if I mean when I am called on to testify in court and whether testifying in court is not part of your regular routine duties, I will say it is almost part of them. A large part of it is given by preparation in testification, in the overflow damage suits against the Sanitary District in the Illinois Valley. Being asked if in connection with that work does it ever become my work to figure the discharge of the river at
2135 its various stages, I will say, I have figured some discharges; yes. As to having done so with reference to the low water volume of the Desplaines river, I don't recall that I have. Being asked if I can do it from the figures I have given here this morning, I will say not from those figures alone, no. The gauge readings would be required. Some standard of flow; something to gauge the river by; some table or curve, or other information which would—. Being asked if there is such a table prepared with reference to each of these points where the gauge is taken, I will say no, I don't think so. Not to my knowledge there is not. As to whether there are any of them, I would say there have

been. I think rating tables were prepared for the gauge at the mouth of Jackson creek and for the E. J. & E. Railroad bridge. I cannot give now the low water volume of the river with relation to the gauge readings taken at Jackson creek. I cannot give it at the mouth of the river.

2136 Being asked if I can give approximately the low water volume of the river at its mouth, I would say no, I would not like to—that would be hazarding a guess. At these stages of water to which I have been testifying, if you want my best judgment in the matter, the flow at the mouth of the Desplaines river, would be, I think somewhere in the neighborhood of four or five hundred thousand cubic feet a minute. As to what contribution from the Sanitary District, I would say that is figured about 300,000 feet. Being asked if it is my judgment that the natural low water flow of the river without the Sanitary District's contribution was from one hundred to two hundred thousand cubic feet per minute, I say at these low water stages; those are not absolutely ex-

2137 treme low, you understand. They are low water, but they are not extreme low water. As to whether the extreme low water is about a thousand cubic feet per minute in the natural sctate of the river, I will say I don't think it is any more, no. Being asked what this river is, and whether its elevation depends very largely upon how much water is permitted to go through the Drainage Canal, I should say it depends to a great extent on that. As to whether the operation of the Lockport Power Plant could shut off the largest part of the entire volume of the river, if those operating it saw fit to do so, I will say it would in low water. Being asked whether back of that the volume of the river is, in low water, almost absolutely dependent upon how much the United States permits to go from Lake Michigan, I would say, yes.

Q. So that these volumes you are talking about are volumes created at low water by the artifices of man.

Object to that.

The WITNESS. Largely; yes.

It is true that it is subject to the control of man at any time. As to a record of the discharge at these points

2138 kept by the Sanitary District hourly, I don't know anything about these flow records at Lockport, whether they are kept or not. I know some have been kept. I have seen tables of the discharges made from the record kept.

We have some of them on file in our office. I do not know how frequently they are taken. Being asked if we have some at your office, and where they were taken, I would say, so far as the basis for them is concerned, I don't know anything about that. They show the discharge daily, but how often during the day they were taken, I am unable to state. As to whether they were taken a number of times during the day, I would presume so, I don't know though. The tabulations we have show nothing in regard to elevations. They simply show the flow. Being asked if they show the flow, and whether that does not indicate the variation in the elevation, I would say, not directly; no. It does affect the
2139 elevation most assuredly. Being asked if I know whether or not that flow varies 100 per cent. in a day, I will say no; I don't know. I don't think so, though. I don't know anything about it. Being asked if I was talking about low water; in the records that I referred to for December, 1910, showing low water, and how they compare with the low water of 1901, at the mouth, I will say at the mouth it would be about two or three feet higher than the low water of 1901. The low water of December 28, 1910, compared with the low water of August 13, 1909, at the foot of Treat's Island
2140 was about 2½ feet higher. August 13, 1909, is the date I am talking about now, and comparing that with the low water of 1901. That was about 2.7 feet, I expect to be precise about it; and that, you understand, is not based upon any gauge records at the head of Treat's Island, but is the depth between the gauge records as taken at the mouth of Jackson creek. The relation of the water at the mouth of Jackson creek to what it was in 1901, low water, would be about the same difference. You see, I am applying that same difference to the head of Treat's Island. I am taking the gauge readings at Jackson creek, so that there I may be accurate and not mere presumption. Being asked if I mean that the difference would be the same at Jackson creek, as it would be at Treat's Island, I will say it would be approximately the same. I have taken into account the differences in the slope between the slope at Jackson creek and the slope at the head of Treat's Island.
2141 As to what allowance have I made for the difference in slope, I will say I have applied the same slope to the water of August 13, 1909, as the Government profile shows for the low water of 1901. The difference in the elevation

in those two years at those two points, the head of Treat's Island and Jackson creek would be about the same. I mean that the difference at Jackson creek would be about 2.7 feet, and the difference at the head of Treat's Island would be about 2.7 feet. That would be true all along Treat's Island, approximately. Of course, I am not saying that is the exact difference but the slopes are dependent on the low water of 1901.

2142 E. H. HEILBRON, called as a witness on behalf of the Government, testified as follows:

Direct Examination by Mr. Cressy.

My occupation is civil engineer. I am connected with the Sanitary District as Division Engineer. I am familiar with the Desplaines river from Dam No. 1, at Joliet to its mouth. I have been connected with the Sanitary District about eighteen years. I have had occasion to make numerous trips up and down the Desplaines river and at various points on the Desplaines river in the years I have been connected with the Sanitary District. I made a trip on December 28, 1910, from Dam No. 1, at Joliet down to the mouth of the
2143 Desplaines river. In that party were Mr. Lyman E. Cooley, Mr. Cressy, Captain Thomas, Captain Brown, Major Meigs, and one or two other gentlemen that I do not recall the names at this time. The trip was made in automobiles, and we visited the location of Dam No. 1, at Joliet, visited the Ruby street bridge at Joliet, the Jefferson street bridge, McDonough street bridge, Brandon bridge, just below Joliet; visited the highway bridges at Millsdale, Treat's Island, Smith bridge, near Channahon, and the site of the proposed Economy Light & Power Company's dam at Dresden Heights.

COUNSEL FOR DEFENDANT. I would like to ask Mr. Dugan another question, if you will allow me to interrupt right there.

(Witness withdrawn temporarily.)

2144 D. H. DUGAN, heretofore called as a witness on behalf of the Government, resumed the stand, and further testified as follows:

Cross-Examination by Mr. Scott.

Being asked if I have the gauge readings for August 12, 1909, I will say, I have not them right here. Being
2145 further asked, have you examined them, I will say, not in detail, no. As to how the elevations of the river on August 12 compared with those on August 13, I would say, there was no great difference. As to how the elevations of August 14 compare with August 13, I would say that there was no great difference.

COUNSEL FOR DEFENDANT. I will ask Mr. Dugan to obtain those readings for the entire month of August and reappear for further cross-examination.

The WITNESS. The 1909 readings I can give you.

COUNSEL FOR DEFENDANT. Please bring those over here, Mr. Dugan. I would like you to point out to me your readings.

(A discussion here ensued off the record.)

COUNSEL FOR DEFENDANT. Let the record show that Mr. Dugan brings over and hands me what purports to be a blue-print headed "Daily gauge readings for 1909, location of gauge, Alexander's mouth of Jackson Creek."

The WITNESS. Being asked, wether I have the daily gauge readings for December, 1910, I will say they were taken, yes. I do not happen to have them here.

COUNSEL FOR DEFENDANT. Will you furnish me a blue-
2146 print similar to this for December, 1910?

The WITNESS. I will furnish it to-morrow.

Being asked whether there is any particular reason why I should furnish it to the United States and not be willing to furnish it to the defendant, I will say I am perfectly willing to furnish it to you, but Mr. Cressy might not be.

COUNSEL FOR GOVERNMENT. We are perfectly willing, provided you pay for it.

(Witness excused.)

E. H. HEILBRON, heretofore called as a witness on behalf of the Government, resumed the stand, and further testified as follows:

Direct Examination Continued by Mr. Cressy.

Being asked to again go over in detail, the time we left Joliet and the amount of time spent and what I observed
2147 at various points in this trip down the river, I will say, we started from Dam No. 1 about noon, possibly 1:00 o'clock; spent some little time at each one of the bridges. At some points probably half an hour. We reached Dresden Heights about half past four or five o'clock and then we returned direct to Joliet. We ran the automobiles to the end of Treat's Island and inspected the conditions at that point, noticeing the current, the width of the stream, the different physical conditions.

Being asked whether I say we ran the automobiles to the head of Treat's Island, and whether we left the road which crosses the island and crosses Millsdale bridge and went through the lots, I would say, yes, went through the field at the head of Treat's Island with the machines. We got out of the machines at the head of the island. Then we inspected the conditions there and I remember some of the gentlemen throwing drift into the stream to notice about what velocity of current there was at that point. Drift was thrown
2148 into the stream near the head of Treat's Island and the drift passed along the east branch of the Desplaines river.

Being asked whether we got into the automobiles at the head of Treat's Island or did you return to the Millsdale bridge on foot, I will say, on foot along the west side of the east branch of the river. The next point we visited below Treat's Island was Smith bridge. At Smith bridge we got out of the machine and noticed the velocity of the current, the width of the river. The next point which we visited below Smith bridge was Whitmore riffles at the mouth of the Du Page river, we went from Smith bridge on the east bank of the Desplaines river. At the Whitmore riffles we threw drift in the river to see about what was the velocity of the current, noticed the general physical conditions. The next point that we visited after Whitmore riffles was the

Kankakee feeder aqueduct. There we noticed the width of the river, the current; and general physical conditions.
2149 From that point we went, I believe, to the mouth of the river.

COUNSEL FOR GOVERNMENT. Mr. Scott, these other men are in a hurry to get away and we shall recall Mr. Heilbron in reference to the trip of August 13, 1909; but I will ask you if you will cross-examine in reference to this trip of December 28, 1910, at this time? Do you care to cross-examine?

COUNSEL FOR DEFENDANT. Not until I hear the rest of his examination. Let him go.

(Witness withdrawn temporarily.)

HENRY F. EIDMANN, called as a witness on behalf of the Government, testified as follows:

Direct Examination by Mr. Cressy.

I am in the real estate business. I am not connected with the Sanitary District of Chicago. I was formerly a member of the board of trustees. I was a member of the board of trustees of the Sanitary District for five years.
2150 On August 13, 1909, I made a trip down the Desplaines river in a boat named the "Mississippi" from McDonough street bridge at Joliet to below the mouth of the Desplaines river. In the party that took that trip were Mr. Thorne, Mr. Clark, Mr. Heilbron; I don't remember the names of the gentlemen that run the boat. There was a Mr. Spencer along. Mr. Spencer performed the duty as photographer.

Q. You may now describe the trip, Mr. Eidman, in detail.

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. On August 13, 1909, we left Joliet at about ten o'clock in the morning; we arrived at Dresden Heights, I would say, about one o'clock in the afternoon. While there we tied up for a few minutes and inspected the work that had been done in the way of the building of a portion of a dam, also a number of construction sheds on the banks of the river. We then continued, taking the boat where we had left it above the rapids, and went through the rapids. The next stop was made at the railroad bridge of the E. J.
2151 & E. Railroad where we had luncheon, and then, as I remember it, we continued the trip with a few stops until we reached Marseilles in the evening.

Being asked if I can describe this boat as to its length, breadth and depth, I should say that the boat was between 30 and 35 feet long. As to how wide, I don't know exactly. I didn't take notice of the width. I will say about 10 or 12 feet probably. As to how much water the boat would draw, probably 13 to 18 inches. We went down the Desplaines river from McDonough street bridge at Joliet clear to the mouth. As to which channel we took down around Treat's Island, I couldn't tell.

Being asked if we experienced any difficulties on that trip going through the rapids, I would say, none that I discovered.

Being asked whether the boat collided with any boulders, I will say, no, I don't think so.

COUNSEL FOR GOVERNMENT. Take these photographs which I now show you, Mr. Eidmann, and state as to whether they were photographs which were taken on that trip, and
2152 correctly represent the boat at the various points in the river. (Handing photographs to witness.)

The WITNESS. They are, yes, sir. No. 4170-8-13-1909, which shows a picture of the party; that is my picture, the first picture on the right hand side.

Cross-Examination by Mr. Scott.

The WITNESS. I was a member of the board of trustees at that time. As to who arranged for this trip, I think Mr. R. R. McCormick, then president of the board, did. This boat was obtained, I understand, somewhere down on the Illinois or Mississippi rivers. I don't know the exact location. I think Mr. Heilbron obtained it.

Being asked if I know why they went down on the Illinois and Mississippi river to get a boat to go down the Desplaines river, I will say, I think we wanted to—I think the engineering department was interested to know whether the rapids at Dresden Heights were navigable or not. That is the
2153 only reason I can give why they should have sent down possibly to the Mississippi river to get a boat to go down that river, the Desplaines river. I don't know why they didn't take any of the boats available from the Chicago river.

Being asked whether this trip was the result of an official action by the board of trustees, I will say, no. It was not done as trustee or made as trustees. I don't know what the expense was of bringing that boat here and getting it

here. I haven't any idea. I do not know by whom it was paid. As to how that boat got to Joliet, I think it was brought up on the canal—on the Illinois and Michigan Canal. From what point, I haven't any idea where it was obtained.

Being asked if I paid any part of the expense of bringing this boat here and making this trip, I will say, no, not that I remember. There was a gentleman there than ran
2154 the boat, claimed to be the owner. I think there were two men connected with the boat—a pilot and the engineer.

Being asked, how long before this trip was actually made was it planned, so far as I knew, I don't think that I had notice of it for more than two weeks from the time that the trip was taken. I got the invitation from Mr. McCormick, as a guest. As to when I went to Joliet that day, if I went that morning, I will say, yes. As to where did I go first when I got to Joliet, I went to the McDonough street bridge. I came directly from Chicago to Joliet and went to the McDonough street bridge. As to where the boat was when I got there, as I remember, it was on the east bank immediately south of the bridge. It had been taken out of the canal and put into the river before I got there. I haven't the slightest idea how it was taken out of the canal.

2155 Being asked whether in point of location of the McDonough street bridge, is at the south end of Joliet, I would say that is in the south end of Joliet. I went aboard there and proceeded to just above the rapids at Dresden Heights. When we left McDonough street bridge, we headed right down the river. We didn't go above McDonough street bridge at all. I do not remember that we stopped anywhere before we got to Dresden Heights. It was a bright day as I remember it; very warm—warm, sunny day. I stayed with the boat to Marseilles; then we continued on to Ottawa by electric car. As to how many of us continued on to Ottawa, either four or five or the party—Mr. Clark, Mr. Thorne, Mr. Heilbron and myself, and I am not sure whether Mr.
2156 Spencer went or not. Mr. McCormick was not with the party. He failed to arrive. I left the boat at Marseilles. That is the last I saw of it. When this boat started, it had a pilot house on top. Where the pilot house came off, I don't exactly remember. I think, as I remember it, the gentleman lost control of his boat and ran into the arches of the bridge instead of keeping into the high parts of the arch, he got swerved to either the right or the left and it took down the

pilot house. I have forgotten the name of the bridge. Being asked whether I know how long we had been going before we met with that, I will say, as I remember it, it was some time after we had left Dresden Heights. I am not very
2157 positive, but that is my impression. At McDonough street we had our pilot house.

Being asked if at Treat's Island we didn't have the pilot house, I will say, I don't know the exact location of Treat's Island, where it is. The back of that picture says Millsdale, but I haven't any idea where Millsdale is. I haven't any idea where Treat's Island is or Millsdale. My recollection is that the pilot house was lost after we left Dresden Heights, that is my impression. I may be mistaken; I am not positive. Being shown a picture which is labeled "Entering the rapids at Dresden Heights," I recognize the picture. We haven't any pilot house there. We must have lost the pilot house before we got there, apparently. I think that is very good proof.

As to having a row boat when we started from Joliet,
2158 attached to the boat or on it, I really don't remember. I think the picture would show.

Being asked if there is one picture which is marked "Leaving Millsdale," and refreshing my memory by that, whether we had a row boat when we started from Joliet, I think we did. As to where did we leave the row boat, I don't know. I don't remember what become of the row boat. I don't think it was ever on board. I think it was just tied with a rope to the back part of the boat as I remember it now after seeing the picture. Being asked if we lost it, I imagine we did if the picture shows there was no row boat later on, or it may have been disconnected. I haven't the slightest idea what became of the row boat. It seems to me there was an attached row boat when we left.

COUNSEL FOR DEFENDANT. Let me see if this picture which I hand you, showing a boat steaming down the river and something back of it, would indicate to you what became of the row boat. (Exhibiting picture to witness.)

The WITNESS. I am not sure that my eyesight is good enough to detect anything in that line.

COUNSEL FOR DEFENDANT. Let me show you right up there. (Indicating.) Right there where my thumb is.

2159 The WITNESS. I would not be able to recognize that; I wouldn't recognize that.

On the picture which is now handed me, labeled on the back "Below Smith's bridge," I don't see a row boat there. I

think it became detached in some way. I don't remember now how. I do not remember anything else that became detached from the boat; nothing outside of the pilot house which was taken off under a bridge. We had the pilot house stacked up on the bow of the boat after it was forcibly removed from the top of the cabin. It was on there, as I remember it, when we arrived at Marseilles.

COUNSEL FOR DEFENDANT. I show you these pictures taken below the point where the one was taken which you have in your hand, and ask you whether it is still your opinion that the pilot house was on there when you arrived at Marseilles.

The WITNESS. I remember now that after it had been temporarily removed, it was taken apart and stacked on
2160 the inside of the cabin. It was very easily taken apart; it was a frail kind of a thing. As to whether we lost anything else in going through the rapids, I will say, not that I know of. As to whether when we were going through the rapids, somebody yelled "Get ready to jump, boys!" I never heard it unless it was in a joking way. Being asked if it was in a joking way, I heard it, but if it was not, then I did not; and whether that is the construction to be placed on it, I would say, no, it was absolutely during our sail through the rapids there was no fear of danger in any way, shape or form, and if someone on the banks of the river or anybody like Wallace Clark who would do a thing of that kind most any time in order to have a good time—why there was no notice taken of it in a serious way because there wasn't any danger.

Being asked if the purpose in making this trip was to procure evidence to be used in litigation concerning the navigability of the Desplaines river, I will say, not to my knowledge.

Being asked for what purpose the Sanitary District trustees desire to ascertain whether the river was navigable, I will say, it was not an order of the board; we were the personal guests of Mr. McCormick. It was on his invi-
2161 tation that the trip was taken. As I remember it, he furnished the boat, procured the boat and expected to be on the trip himself and was very much interested to know whether the rapids were navigable or not with the proper kind of a boat that had some weight to it.

COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive to the question.

(Witness excused.)

JAMES W. THORNE, called as a witness on behalf of the Government, testified as follows:

Direct Examination by Mr. Cressy.

I am a merchant. I am not in any way connected with the Sanitary District of Chicago. I made this trip on August 13, 1909, which Mr. Eidmann has just testified about.

Q. You may proceed and describe this trip, Mr. Thorne.

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. It was on August 13, or thereabouts,
2162 1909, we left the south bridge at Joliet between ten and eleven in the morning on board the steamer Mississippi. I joined the party on the boat. We made about two stops to give the photographer a chance to take pictures and then tied up about a mile or half a mile above Dresden Heights and went ashore and proceeded by foot to inspect the dam before going over, and then returned to the Mississippi and shot the rapids and proceeded without any further stops except temporary shutdown, to Marseilles, where we arrived early in the evening, seven or eight o'clock. We left the boat and went to Ottawa by trolley car. Being asked if we experienced any difficulty between this south bridge at Joliet and the dam at Dresden Heights in reference to the navigation of the river, I would say, we collided with a bridge shortly after starting, I think it was known as the Brandon road bridge. It was due, however, to the carelessness of the pilot. I don't think our boat struck against any boulders in going down stream. The size of the boat, I should estimate to be 35 or 40 feet long, 10 or 12 feet beam, propelled by a gasoline engine driving a stern wheel. The crew consisted of one man. As to about how much water the boat drew, I should estimate a foot and a half to two feet.

2163 Q. Look at these photographs which I now show you, Mr. Thorne, and state whether they show yourself in one of them, and if they correctly depict the trip on August 13, 1909.

That is objected to; they may correctly depict the particular points at the time when the trip was taken, but no man can say that such pictures correctly depict the entire trip.

The WITNESS. What is the last part of that?

COUNSEL FOR DEFENDANT. I say no one can say or be expected to say that six or eight pictures correctly depict the entire trip.

COUNSEL FOR GOVERNMENT. I simply want to show that these pictures were pictures taken on that trip.

COUNSEL FOR DEFENDANT. I have no doubt that is true.

The WITNESS. I can identify them all, and also identify myself as being one of them, except this picture here. (Indicating.) That seems to have gotten in with them.

Being asked if my photograph is in that picture (indicating), I will say yes. No. 2 from the left. The second one from the left is a photograph of myself—No. 4170-8-13-1909.

Cross-Examination by Mr. Scott.

As to who took the pictures, I will say, Mr. Spencer,
2164 the official photographer, the gentleman sitting over there next to Mr. Eidmann. These were all the pictures that were taken on that trip, except some I took myself.
2165 As to whether these eleven photographs which were handed me and which were identified by me, are all the photographs which were taken by Mr. Spencer on that trip, I of course cannot answer that question, I don't know. Approximately, yes. As to where Mr. Spencer was when he took these pictures, I will say, we made several landings and put him ashore in order to give him an opportunity. Being asked, if Mr. Spencer took any pictures when the boat was in the rapids, I will say, yes, there are four negatives there, I believe. Being asked whether he took any when the boat was in the rapids at Dresden Heights, I would say, yes.

COUNSEL FOR DEFENDANT. Will you pick out those that show the boat in the rapids at Dresden Heights?

The WITNESS. Yes, there they are in the order of taking, right now. (Handing photographs to counsel.) This one marked 4178, that is entering the rapids, and 4179 is leaving the rapids, and 4180 is after the rapids have been left
2166 and was in the mouth of the Kankakee river, and 4181 was after the boat was out of the rapids heading toward the Illinois river.

Being asked if there are any taken while the boat was in the rapids, I would say the one marked "Entering the rapids," I believe, shows the boat right at the top of the crest of the waves, so to speak. That is the only picture taken with

the boat in the rapids as far as I know. Being asked, whether I was on shore; and if not I don't know how many snaps Mr. Spencer made at it, I will say I know he didn't have much time. There would only be time to change one plate. He would have to move pretty lively. Going through there we were going one hundred feet in about two seconds. We
2167 did not attempt to go up those rapids. We were bound downward. We were not interested in going back. There was an effort made at one point in the swift water of the river to go up stream. Being asked, at what point in the swift water of the river, I will say, there is one photograph taken there (indicating); we put Mr. Spencer ashore up near Brandon bridge somewhere and then we turned around and passed in view while he took a picture of us going up stream. Being asked, whether that was not at Brandon bridge, or down near the Millsdale bridge at Treat's Island, I will say, I am not acquainted with the terms. As to where we lost the cabin, and whether I want to change my testimony, I will say, I will let the testimony stand. I recall Mr. Spencer taking our pictures from the bridge; he was on the bridge as we went under it. At Brandon bridge. So my testimony stands as to that. As to where we turned the boat around, this is the photograph. I am unable to testify where it was taken.
2168 We came up stream for three or four hundred yards.

Q. Three or four hundred yards above what bridge? you don't know where this was taken. It says on the back "Turning to make a landing at Millsdale." Do you re-
2169 member the bridge there?

The WITNESS. I don't know the bridge, no.

Being asked, if we went above or below the bridge, I will say, we went below the bridge; when we turned back up stream it was below the bridge. We did not endeavor to go upstream above the Millsdale bridge. We went up three or four hundred yards and after landing, we had to make a landing to pick up Mr. Spencer there. He had his camera on shore. That was the object in turning around and coming back, to pick him up.

As to where I was standing when the pilot house was carried away, I will say on the forward deck. The pilot was in the pilot house above back of me. His carelessness consisted in letting the stern slough around, to use a nautical expression. Being asked, if the water is very swift there, I would say, not unreasonably, but if I remember correctly he had to

strike the girders of the bridge at an angle and straighten out and pass through on a parellel line and he didn't do it.
2170 As to why he had to strike the girders of the bridge at an angle I will say because they were not set parallel to the river there. Being asked, if there had not been a swift current, would it make any difference whether he struck them at an angle or not, I should say, it would have made the same difference regardless of current whether it was a smooth river or a swift river, because he had to take her in between a little parallel space between two girders. The spans there are to the best of my remembrance between twelve and fifteen feet. Being asked, whether I haven't got the wrong bridge, I will say, I don't know the name of the bridges. Being asked whether there was any man on this boat outside of your party, except the owner; I will say the captain and the crew, he was in entire charge of the boat to the best of my recollection. He is not here. I do not remember his name. As to where he came from, I only know by hearsay. He came down the
2171 river somewhere—down the Illinois river; whether it is the Illinois or the Mississippi, I don't know; I simply was told he came from down the river. This party was on the boat when I got there. I joined them on the boat. I came down from Chicago on the train. I got aboard at Midlothian, Illinois.

Being asked, if I said that I had some pictures taken by myself, and I have sent those to Mr. Clark, or somebody else, I will say I think I gave a duplicate set to Mr. Heilbron and Mr. Clark. I have duplicates.

COUNSEL FOR DEFENDANT. So when I get these I have got all of them except those that you have censored?

The WITNESS. Yes, sir.

Being asked, if any measurements were made of that boat to ascertain its actual dimensions or its actual draught, I will say, not to my knowledge. As to where the row boat was lost, I don't believe it was lost. As to where did I see it last, I would say, at some place we tied up for lunch. It was
2172 below the rapids, Below the Dresden Heights rapids; the boat was there then. I recall seeing it jammed in on one side of the boat and we used it to step ashore on. That is all I can remember. When we left Joliet they had it trailing out on one side. Being asked, if I changed its position at any place on the river, I will say, I don't remember. Being asked, to look at these pictures and state whether I

find it trailing out on any picture taken after I left Millsdale, I will say, yes, on the one leaving the Dresden Heights rapids, No. 4178.

COUNSEL FOR DEFENDANT. May I look at it, please? (Picture handed counsel.)

The WITNESS. Being asked, if we lost it once and picked it up afterwards, I have no recollection of having any trouble with the boat. Being asked, whether I find any indication of it on the pictures." After leaving Millsdale," I have it on three other pictures below Brandon's Bridge. I don't know where Millsdale is.

COUNSEL FOR DEFENDANT. Show us those please, will you, Mr. Thorne?

2173 The WITNESS. This one. (Indicating.) I don't believe I handed you that one.

COUNSEL FOR DEFENDANT. Yes, that is one of the three you handed me and that is the only one below Millsdale.

The WITNESS. Oh, yes, I have it. You will have to put on your glasses.

COUNSEL FOR DEFENDANT. I have them on. It needs glasses to find it.

The WITNESS. You will see the stern of the boat sticking out on the other side of the paddle wheel. You will only see about one foot of the boat.

COUNSEL FOR DEFENDANT. I see it in that case; you are right. Will you kindly indicate to me what this is on 4180, floating here below at the right hand side of the picture while the steamer is at the left hand side of the picture.

The WITNESS. I can only surmise that it is our skiff. As to how far it was from the boat, I should say three hundred yards. Being asked, if my surmise is correct, then the boat was lost at some stage and recovered at another stage, I will say, yes. We did not attempt to go up any of the tributaries of the Desplaines on that trip, the DuPage or Hickory

2174 Creek or Jackson's Creek. We kept right to the main river.

Re-direct Examination by Mr. Cressy.

Q. Mr. Thorne, on your cross-examination, you were asked as to the distances between the spans of the river, I want to find out just what you mean by your answer of 12 feet.

Objected to, the 12 feet speaks for itself. 12 feet is 12 feet.

The WITNESS. The bridge is constructed with big steel girders set tranversely vertical. They were spaced about twelve to fifteen feet apart. They were three feet thick, I should assume. I did not intend to refer to these stone piers. I referred to these iron girders which are shown on 4172.

COUNSEL FOR DEFENDANT. Mr. Cressy, let me ask you;
2175 do you consider that what you are now showing him is the bridge that he referred to in his testimony?

The WITNESS. Yes, sir.

Re-cross Examination by Mr. Scott.

Being asked, how I came to make this trip, I will say I went at the invitation of Mr. R. R. McCormick. Mr. McCormick knows that the firm I am interested in is interested also in this Deep Waterway-to-the-Gulf, and also personal friendship, and he asked me to come and join the party down the canal, down the river. As to the purpose of the trip, he never told me; just asked me to come. Nothing was said about litigation pending as to the navigability of the river. As to when did I first know that I might be called upon to testify as to that trip, I will say, yesterday. I said the firm I am connected with, is interested in the Lakes-to-the-Gulf Waterway as providing better shipping facilities.

2176 Being asked, what participation has that firm taken in the effort to get a deep waterway to the Gulf, I would say, nothing so far. No members of it are associated with members of the Deep Waterway association. Being asked whether any members of it have been upon any committees of the Chicago Association of Commerce, the committee having to do with the deep waterway, I will say, the initial move, which will be the improvement of the Chicago river, W. C. Thorne, I beleive, is on a committee. His position is Vice-President of Montgomery Ward & Company. The committee that he is on is the Outer Harbor Ways. That is the only committee or association of that kind that any member of our company is associated with or connected with as far as I know.

COUNSEL FOR DEFENDANT. There is a memorandum; will you let me have the photographs you speak of? (Handing paper to the witness.)

The WITNESS. Yes.

(Witness excused.)

2177 COUNSEL FOR DEFENDANT. I want this document marked for identification as being the document handed to me by Mr. Dugan, when I asked for the daily gauge readings for 1909.

COUNSEL FOR GOVERNMENT. The record ought to show that Mr. Dugan has also furnished you with the gauge readings for the purpose of inspection with reference to the years whatever they were. Will you kindly read off those years?

COUNSEL FOR DEFENDANT. Yes. Will you mark this Dugan Exhibit 1 for identification, of this date?

(The document so offered and identified was thereupon marked "Dugan's Exhibit 1 for Identification, March 7, 1911.")

COUNSEL FOR DEFENDANT. Let the record show that Mr. Dugan furnished me four blue prints, being dated respectively, "Daily Gauge Readings for the year 1905, location of gauge, Alexander's Jackson Creek;" "Daily Gauge Readings, location of gauge, Alexander's, Jackson Creek, for the year 1906;" "Daily Gauge Readings, location of gauge, Alexander's, Jackson Creek, for the year 1907;" "Daily Gauge Readings for the year 1908, location of gauge Alexander's, mouth of Jackson Creek."

WALLACE G. CLARK, called as a witness on behalf of the Government, testified as follows:

Direct Examination by Mr. Cressy.

2178 My occupation is real estate business. I am connected with the Sanitary District of Chicago as one of the trustees. I have been connected with the Sanitary District about five and a half years. On August 13, 1909, I made a trip from McDonough street in the City of Joliet to the mouth of the Desplaines river; we left Joliet on board the boat Mississippi, a stern wheel boat, Mississippi type, about ten o'clock in the morning, and continued through to Dresden Heights, or just above Dresden Heights, except for two or three stops which were made for the purpose of taking on or letting off the official photographer of the District.

Leaving Dresden Heights along about ten o'clock we then made a stop shortly after that for lunch in which we went ashore to try to increase our commissary department. Then

we made a stop again at Morris, and we arrived at Marseilles, I should say, at half past six or half past seven in the evening.

2179 As to whether I am familiar with the places along the Desplaines river, such as Brandon's bridge, Millsdale Bridge, I will say, some of the points, not all of them. I am familiar with Brandon's Bridge. As to Millsdale bridge, I will say, this was my first trip, my first stop at Millsdale. Being asked if I could say as to which channel around Treat's Island we took, I would say, yes, on the east side of Treat's Island. As to the boat, it was a boat, as I said before, stern wheel, what we term as a Mississippi type boat, about 35 feet in length, and between 8 and 9 feet beam, and a draught of a foot and a half. The boat was in the service of the Sanitary District for some two years before this with our surveying crews on the Illinois river. I had occasion to see this boat prior to the trip that I made down the Desplaines river. I had been on the boat a number of times on the Illinois river.

2180 Q. Did you experience any difficulty going down the Desplaines river and through the east channel at Treat's Island from McDonough street to the mouth of the river?

That is objected to, as incompetent, immaterial and as irrelevant, and as being a conclusion of the witness and not a description of what occurred.

The WITNESS. No, none whatever. We did not collide with any bowlders. As to why I made this trip down the Desplaines river, I will say, it is a trip that had been contemplated by some of the members of the Board for two years or more. The Trustees, most of them, had been over the Illinois river and in studying the various suits that have been brought against the Sanitary District for overflow, extending all the way down as far as Grafton, and we had been over all that territory except that in the Desplaines river, and that was the object of my trip, and it was one which we had been contemplating making for a year or two, but had been put off for one reason or another.

Being asked to look at these eleven photographs which are now shown me and say if they were photographs which
2181 were taken on that trip on August 13, 1909, I will say, yes; No. 4170 there is myself at the left-hand side. The first figure on the left is a photograph of myself.

Cross-Examination by Mr. Scott.

Being asked if I have ever been down the river before by land, I would say, I have been down, followed it down, that is the I. and M. canal, which parallels the river. Being asked whether if for the mere purpose of determining what land would be overflowed, was there any advantage in going by the river, I will say, yes, observations. For the purpose of getting the general character, the general lay of the land. Whether it was low land, surrounding the river, or land with a rise of a foot or so, would affect materially, as it does in the Illinois river. So that we could act more intelligently on matters that were coming up for settlement or for suits before the Board. There were matters coming up for
2182 settlement or suit before the Board for overflow of the Desplaines river at any point below Lake Joliet, as I remember in various places.

Q. Was any examination made upon this trip of the DuPage river, or Hickory creek, or Jackson creek?

The WITNESS. On this trip Mr. Heilbron explained to us as we went down, the various suits pending against the District, and gave us more or less information.

COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive to the question, and ask that the question be read again to the witness.

(Question read.)

The WITNESS. No, sir; except as to the mouth of those.

Being asked whether we went into the mouth of any of these rivers, I will say, no, just observing going down the main channel. I do not know how far that boat that I went down upon could have been navigated up the DuPage river, or Jackson creek, or Hickory Creek, or Riley's creek. This boat had been in the service of the Drainage District for
2183 some two years prior to the trip. I should say two years and possibly more. It was in the service of the Drainage District immediately prior to this trip down the Desplaines river at Chillicothe, if I remember. I cannot say that it was at Chillicothe at the time it was brought to Joliet for this trip but that was the neighborhood in which the boat was in service and had been prior to this time. As to whether or not that boat was within two hundred miles of Chillicothe at the time it started up to make this trip, I couldn't say. Being asked, as a matter of fact, wasn't it at Muscatine, Iowa, I will say, no. Being asked, if I know that

of my own knowledge, I will say I know it was in the service of the Sanitary District and it was not in the service of the Sanitary District if it was at Muscatine. Therefore, reasoning that way I knew it was not there. As to who owned the boat at that time, I couldn't give you the party's name.

2184 It was not owned by the Sanitary District but it was leased for them. We rented it, as I remember, by the month or season; I am not sure. As to whether it was by the month or season, I could not say. I know that it was rented, but under what terms it was rented I don't know, but I know—I have been down there a number of times, several times when that boat was in service and I knew it was in the continuous service of the Sanitary District. I do not know anything about the details, as to the rental of it. Being asked how the boat got to Joliet, I couldn't answer that. Being asked, if it didn't come up the river as far as I know, I will say, not as far as I know. I never heard of it coming up the river. Being asked if any effort was made after I had gone down the Desplaines river to the Illinois, to return by the Desplaines river, I would say, no, only coming up a few hundred feet to take on the photographer.

2185 Q. You didn't come up any few hundred after you had gotten down to the Illinois river. My question was, after you had gone down the Desplaines to the Illinois river?

The Witness. No, there was no object to our coming back. Being asked if that trip had any relation to determining whether the river was navigable, I would say that was of interest. As to whether that was one of the purposes of the trip, I will say, not as far as I was concerned. Being asked if I heard the matter of that element in it discussed at all, I would say, that has been a general discussion for the last year or more.

Q. I am not asking you about general discussions for the last year or more, as to whether the river is navigable. My questions are directed solely to this trip.

The Witness. I say, no, as to my recollection. Being asked if whether it was not at the same time given out by the Sanitary District to the newspapers as proof that the river was navigable, I will say, my remembrance is that I saw some such statement in the paper, but I don't know where it originated from. As to why that particular boat was brought from Chillicothe for the purpose of making this trip, I will

say, as stated before, it was in line of the investigation
2186 we had been talking of making for the two years previous, and we considered that that was the most available boat that we had for the purpose. We had other boats—several other boats. We had other boats on the Sanitary District channel. As to how many, I will say we had only one, as I remember it, at that time. Being asked, what was the size of that one that we had on the Sanitary District channel, I would say that boat is 85 feet in length, and a capacity of carrying 125 to 150 people. That boat draws from three to three and a half feet. Being asked whether we have any other boats at Chicago, I will say we may have one small boat. The dimension of that small boat is 18 to 20 feet in length. It is gasoline. Its beam is about 5 to 5½ feet. Its draught is, I should say, two and a half to three feet; two and a half feet.

Q. Now, have you mentioned all the boats that you then had at Chicago or on the Drainage District canal?

2187 Objected to, as not proper cross-examination.

The WITNESS. I think so.

Q. What boats did you have on the Illinois river at that time?

That is also objected to as not proper cross-examination.

The WITNESS. We had two or three gasoline boats. I think they were all at Chillicothe at that time; at Chillicothe and the vicinity. I say they were operating from that point; they were operating surveying crews at various points, and these boats were used by them. They might be down the river or up the river. We have quite a fleet of boats on the Illinois river. As to whether I took any steps to ascertain for myself the draught of this boat, I will say, no. I called it a Mississippi type of boat. It is what I would call
2188 a Mississippi type on account of being a stern wheeler. That is why I called it a Mississippi type of boat. As to whether it is a boat that has no ways along the sides where the cabin extends out practically to the side of the boat, I will say, of course there is the gunwale, as you call it, I guess. It is not a freight carrier; still we could carry freight on it. Being asked if it is just a flat boat covered almost entirely by the cabin house, I will say, yes. It has quite a forward deck on it. I should call the structure, as far as the upper part is concerned, light. The hull is heavy enough to carry freight on. I don't know the size of the timbers. As

to whether I know the depth of the hull, I do not know; just my general observation and my knowledge of boats; I have always owned boats myself, all my business life.

Q. That kind of boat?

The WITNESS. I have had various styles of steam and gasoline boats, and one of my summer outings has always been with boats for the last few years.

COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive to the question, and I ask that the question be read to the witness.

2189 (Question read.)

Q. The question is whether you have owned that type of boats.

The WITNESS. Not this type of boat.

COUNSEL FOR DEFENDANT. That was th only question.

2190 E. B. SPENCER, called as a witness on behalf of the Government, testified as follows:

Direct Examination by Mr. Cressy.

My occupation is photographer; I am in the employ of the Sanitary District; I have been in the employ of the Sanitary District of Chicago about ten years. On August 13, 1909, I made a trip down the Desplaines river, from McDonough street, Joliet, to the mouth of the river.

Q. Will you please explain that trip, or explain what you did on that trip?

Objected to, as immaterial, incompetent and irrelevant.

2191 The WITNESS. Why, I went along as photographer; I made the first exposure at the south side of the McDonough street bridge, showing the boat in the Desplaines river.

COUNSEL FOR THE GOVERNMENT. Take these pictures which I now show you and state whether those pictures were made by you on August 13, 1909?

THE WITNESS. Yes.

As to the first exposure which I made on that day. I was standing on the bank just on the south side of McDonough street bridge. I am speaking now of No. 4170. The picture shows the steamer, the boat Mississippi, lying up at the edge of the bank. That is just south of McDonough street bridge.

The next picture, 4172 is made as the boat was approaching Brandon's road bridge, from the east bank in going down the river, the left hand bank. That refers to both pic-
2192 tures that I have mentioned. The next picture was taken from the right hand end of the east bridge at Millsdale showing the boat after she had passed under the bridge. That is the left hand channel of the river around Treat's Island, the east channel. The picture would be taken from the right hand side of the left hand channel. That is No. 4173. No. 4174 is made from a point on the left hand side of the river showing the boat just about landing, at a point below Millsdale bridge. The next one, 4175, is a picture of the boat below the Millsdale bridge, pointed upstream from the left hand bank.

These three pictures that I have mentioned as referring to the Millsdale bridge, I refer to the bridge over the
2193 left hand channel at Treat's Island. The next picture, No. 4176, shows the boat passing under Smith's bridge near Channahon, made from the left hand bank of the river. Number 4177 shows the boat after she had passed under Smith's bridge, pretty near, as I judge, below Smith's bridge, I don't know just how far, probably five or six hundred feet below Smith's bridge. From the same point, from the left hand bank of the river. Number 4178 shows the boat entering the rapids; in fact it is in the top of the rapids at Dresden Heights. It is made from the right hand side of the river.

Being asked whether when I say the right hand side of the river do I mean that the picture was taken from the bank itself I will say I was standing on the water's edge at the edge of the fence where the Dresden dam site is. Number 4179 is showing the boat after she is partially—almost out of the rapids, made from the same point as the previous picture. Number 4180 shows the boat drawn out of the rapids in toward the waters of the Kankakee. And here she is still further away in turning out from the waters of the Kankakee back into the Illinois river. That is No. 4181. I have examined those very critically; those are photographs which
2194 I made from negatives which I took on August 13, 1909.

As to how I came to take these pictures I will say I was ordered by somebody in the Sanitary District, I don't know who, to take the train and go to Joliet to the McDonough street bridge, and find the boat there. Being asked if I know for what purpose these pictures were taken, I will say, no, I don't know any particular purpose.

COUNSEL FOR THE GOVERNMENT. We offer these photographs in evidence, and ask to have them marked Spencer Exhibits 1, 2, 3, 4, up to 11.

Objected to, as incompetent, immaterial and irrelevant, and in addition, because they show the boat but at eleven points on the entire journey from Joliet to the mouth of the river.

(The said photographs so offered in evidence were marked respectively "Government Exhibits Spencer 1 to 11, inclusive.")

Q. Look at this letter which I now show you, and state what that is.

The WITNESS. I received a copy of this letter. It is instructions for me to start on my annual trip down the river, down the Illinois river, taking photographs and in connection with the overflow suits.

2195 COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive to the question; and further because it purports to be the contents of the document and not the best evidence, because it is *res inter alias actos.*

COUNSEL FOR THE GOVERNMENT. The letter is dated Chillicothe, Illinois, July 6, 1909. Was that letter received by you in the course of your employment?

The WITNESS. It was, yes sir.

COUNSEL FOR GOVERNMENT. We offer this letter in evidence and ask to have it marked Spencer Exhibit 12.

COUNSEL FOR DEFENDANT. Objected to, as incompetent, immaterial and irrelevant, and is the further objection that it does not appear to be an original letter.

COUNSEL FOR GOVERNMENT. Q. I will ask you as to whether that is a true and exact copy of the original letter.

The WITNESS. Yes, sir.

COUNSEL FOR GOVERNMENT. We offer it in evidence.

COUNSEL FOR DEFENDANT. I maintain the objection.

(The said letter so offered in evidence was marked "Governments Exhibit Spencer 12.")

COUNSEL FOR GOVERNMENT. Would you like to have us produce the original letter for your inspection?

COUNSEL FOR DEFENDANT. If you desire to use the letter at all I would suggest that you produce it.

2196 COUNSEL FOR GOVERNMENT. Q. I will ask you whether you are able to produce the original letter?

The WITNESS. No, I am not able to produce the original

letter. They have the copy of the letter at the office; that is the letter-press copy. I don't know what became of the original letter. I may have it possible, I am not certain. I wouldn't swear to it. As to where I got this copy, I got it at the office of the Sanitary District.

Being asked if I compared it with the original press book copy, I will say I have casually compared it. I read the letter over. I think it is virtually the same thing verbatim.

COUNSEL FOR GOVERNMENT. We offer this letter in evidence.

COUNSEL FOR DEFENDANT. Objected to for the reasons given.

(Which letter so offered in evidence is marked Spencer Exhibit 12 and is in words and figures as follows):

(Form of letterhead of The Sanitary District of Chicago.)

"Chillicothe, Ill., July 6th, 1909.

Mr. E. B. Spencer,
C/o S. D. Warehouse,
31st St. & Western Boul.,
Chicago, Ill.

Dear Sir:

The launch 'Mississippi' is now located at the Jackson Street dam in Joliet, and is prepared to start on a trip down the Valley. I thought possibly you might desire to begin the work of taking views along the Valley immediately after the Fourth, so arranged to have Mr. Alexander, with the 'Mississippi' at Joliet ready for your use. You will find a complete set of maps, colored for your use, on the 'Mississippi,' showing location of all properties involved in suit.

With kindest regards, I am,

Very truly yours,
(Signed) E. H. HEILBRON,
Division Engineer."

Cross-Examination by Mr. Scott.

Being asked if this letter is dated July 6, 1909, and as to when I first saw the launch Mississippi referred to therein, I will say in two or three days after, at the bridge at Joliet, in the canal. As to where I began my trip to make photographs showing the location of the bridges involved in the

suit, I will say I think it was about two days after I
2197 received that letter, I went down in the Mississippi. As to what water I used to go down, I used the I. & M. canal. I did not go down the river at that time with the boat. As to how long I was on that trip, I will say I was all through the month of July into the fore part of August. As to when I got instructions to go down and take photographs on this trip down the river; I will say two or three days prior, I think it was; I wouldn't say for certain. I think it was a day or two before, something like that. They called me up over the telephone and told me to take the train for Joliet and meet the steamer Mississippi at McDonough street bridge. Being asked if I was given any reason, I will say, no, no reason
2198 in particular. Being asked whether the Mississippi is a steamer I will say, no, she isn't a steamer, she is a launch propelled by gasoline. Being asked if I was told why I was to take photographs on that trip, I will say, no. I had no instructions as to what course I should pursue, at what points I should take the photographs. It was left entirely to me. Being asked if there were any indications what the photographs were to be used for, I will say none whatever. As to who called me over the phone, that I can't remember. As to how many photographs I took on that trip, I will say I took twelve, I believe. The kind of a camera I used was an Outing camera, a plate camera. As to how many plates I took with me, I had twelve. I think I had a separate grip;
2199 I wouldn't be certain. I sometimes carry a separate grip; I wouldn't be certain whether I had it with me or not. If I was certain I had that separate grip I would have thirty plates, but I am not positive that I did have that second grip. As to how many plates I used, I used only twelve. The twelfth is a duplicate of the first picture I made. You will notice a jump in the numbers there. Being asked whether I can produce the twelfth, I will say the twelfth is a destroyed plate. Being asked if I took photograph 810 on that day (photograph handed witness), I will say no. The pictures are dated. This is the 5th, 10th, 1909.

Being asked if I exercised simply my own judgment as to what point from which I would take a picture of the boat, I will say, Oh, no. I said I would take it at the Brandon street bridge. Took it first when we started and then took
2200 it again at the Brandon street bridge. Being asked whether anybody gave me any instructions as to where I should take it, I will say, yes, Mr. Heilbron. Being asked

whether I took any picture when the boat was in the rapids, not meaning by this entering or leaving, but when the boat was in the rapids at Dresden Heights, I will say no. As to how long the rapids are, I don't know. I should judge a couple of hundred feet, probably more, probably less. As to whose handwriting is upon the back of these pictures, "Entering the rapids," "Leaving the rapids," and so forth, I will say it is mine, I believe. As to when I put that on, I
2201 will say, why, immediately after those pictures were finished, after I had gotten home. As to where did the Mississippi lose its row boat, I think it became detached just below the rapids. Being asked if I saw it become detached, I will say, no, I was not looking for that. I was busy making pictures. As to whether after the boat lost the row boat did it not back up and get it, that I don't know. I suppose it did. I don't know; I was busy folding up. Being asked if the picture I have marked "Leaving the rapids, Dresden Heights" is really leaving the rapids; or was it backing up the boat at that point, I will say she was going down. As to which I made first 4179 or 4180, I think 4179 first. The boat got further away and it was naturally smaller on the second shot. As to where they lost their boat, I don't know if they lost the boat or not. I think we landed the boat at Marseilles,
2202 as far as my recollection is concerned, but I was busy making pictures. I wasn't paying any attention to what they were doing on the boat.

Q. You find the boat shown on 4180, the rowboat at the right hand end of the picture, and the Mississippi to the left of the picture, do you not?

The WITNESS. I don't know; the picture shows just where it was. I wasn't on the boat, you know.

That is objected to, the picture is the best evidence.

The WITNESS. I wasn't on the boat, you know.

Q. Look at it and tell us what this black object that looks like a rowboat is at the right hand of the picture?

Objected to, on the ground that the picture speaks for itself.

2203 The WITNESS. Way off there, do you mean (indicating). It looks something like it. I don't know whether it is or not.

Being asked whether I saw any row boats there that day other than the one the Mississippi had, I will say no. Being asked whether after having examined that picture which I had last in my hand, and whether it is my opinion that it is

the row boat of the Mississippi, I will say it looks to me like a boat, yes. As to whether in looking at the river for the purpose of photographing it, I didn't see the object in it, I will say, I wasn't looking at the river; I was watching this boat go over those rapids. As to whether when I took the picture did I not have to see the river, I will say I focused on the water. As to seeing the rowboat some hundreds of yards back of the launch, I said I did not. Being asked whether if it lost the boat I would know where it lost it, I will say I don't know.

2304 Q. How do you account for the presence of the rowboat in the picture if it was not lost from the launch?

Objected to, as not proper cross-examination especially in view of the answers.

The WITNESS. Well, there might to a boat lying in the river. I don't know.

Q. Do you think there would have been likely to be a boat without anybody in it, adrift there, unless it was from the Mississippi?

The WITNESS. I don't know.

COUNSEL FOR GOVERNMENT. I renew the objection on the ground that the witness has stated he was not making observations in reference to the presence of the boat. He has already answered the questions.

The WITNESS. As to whether I was on the shore at the time the boat lost a cabin at Brandon's bridge, I will say, yes. Being asked if I observed it, I will say I just simply heard it, that is all. I was putting my slide back in the camera and folding up my camera preparatory to leaving.

(Witness excused.)

2205 E. H. HEILBRON, heretofore called as a witness on behalf of the Government, resumed the stand and further testified as follows:

Direct Examination (Continued) by Mr. Cressy.

I stated this morning that I had been in the employ of the Sanitary District for eighteen years. Prior to my employment by the Sanitary District I had no experience as an engineer. My work with the Sanitary District has been practically every class of work the Sanitary District has undertaken. I

have held all of the positions in the engineering department, from laborer to division engineer, the one I now hold.

As to what experience I have had upon the Desplaines river from its junction with the Kankakee to Dam No. 1 at Joliet I will say I was in charge of topographic surveys of the Desplaines valley from Joliet to the mouth of the Kankakee river; the establishment of gauges; soundings in the river; profiles; the work generally taken in connection with the topographic survey, all the work to show all of the physical conditions.

2206 As to whether I am familiar with the slopes of the Desplaines river from Dam No. 1 at Joliet to its mouth, I would say, in a general way. I couldn't state offhand the slope between certain points without examining the record. As to whether I have examined the profile of the Ernst Board, known as House Report 263 of 1905, and if I am familiar with it, I will say, yes, the profile in connection with the survey.

Being asked, if I am familiar with the depths in the Desplaines river from Dam No. 1 at Joliet, I would say, yes, from an examination of the Government survey, yes, I have had occasion to make trips up and down the Desplaines river in boats, a good many, many times. In establishing high water marks, gauge boards and making the topographic survey I have navigated the Desplaines river from Joliet to the mouth of the Kankakee river, I believe, as many as twenty-five times. I have gone upstream in a rowboat. I rowed the boat from the Kankakee feeder aqueduct up to Jackson creek. As I remember it, that was about 1904. And I have also rowed a boat upstream in Lake Joliet and in the DuPage river pool

2207 below Smith's bridge. I don't recall each separate trip made during the time we were making the topographic trips. I made the trip with Mr. Eidman, Captain Brown, Mr. Clark, Mr. Spencer, and a young man by the name of Guy Alexander on the 13th of August, 1909, from McDonough street, Joliet, to Marseilles in the boat Mississippi.

Q. You may describe that trip, telling for what purpose it was made and what took place on the trip.

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. Mr. R. R. McCormick, who was then the president of the Sanitary District, had often referred to a trip along the Desplaines in a power boat and asked me whether it could be made, and I told him it could and he desired to arrange for it. In connection with that I told him that we would require a low water stage; the boat I intended to use

could not pass under the bridges at a high water stage, and I arranged this trip for the boat Mississippi to go down the Desplaines river, and notified him when I had got the boat from the I. & M. canal into the Desplaines river. At that time I understood that several of the trustees were to go down and look over the lands, and I was to explain conditions on the way down. That was in connection with my official
2208 duties with the Sanitary District. We have, as I recall it, in the neighborhood of fifty damage suits in Will County. The Will County line is near the mouth of the Kankakee river. They had often taken a trip along the I. & M. canal and at various points the I. & M. canal is some distance from the river, over a mile at Channahon, and none of the trustees had ever seen the Desplaines river or examined that territory between Joliet and the Kankakee river except along the I. & M. canal.

Being asked whether attention was paid that day to these fifty damage suits that were pending, as I say, in Will County, I will say, yes, as we went along I explained the location of the different suits, and the property owners and the physical conditions in connection with each suit. As to the trip itself in detail, we first transferred the boat from the I. & M. canal to the Desplaines river a short distance below McDonough street I should say, in the neighborhood of a thousand feet, and the boat ran up to McDonough street and laid up at the east bank of the river just south of McDonough street bridge. We started from that point and ran down to Brandon's bridge, where we had a slight accident; the pilot house, one corner of it striking the iron work of the bridge and being torn down. From that point we went to the Millsdale
2209 highway bridge, over the east branch of the Desplaines river at Millsdale, passing through and under the bridge, went down about 1500 feet and turned the boat around and came back to within about 100 feet of the bridge, where we took on Spencer, who had taken a picture of the boat at that point. We then proceeded to Smith's bridge, took Spencer to the shore and he walked down to the shore and took a picture as we passed underneath; and then we turned around and picked him up, after which we proceeded down a short distance below the Kankakee feeder aqueduct, where we left the boat and walked down to the Economy Light & Power Company dam at Dresden Heights and looked over the conditions at that point and then went back to the boat and continued through the rapids, and continued on to the E., J. & E.

Railroad bridge where we had lunch; and then proceeded on our way to Marseilles, stopping at Morris for a short time. We had a boat tied on to the Mississippi, a small rowboat which we carried down there on our trip, the painter parted as we were going through the rapids at the Economy
2210 Light & Power Company dam, and the boat drifted down the Illinois river. We proceeded down below the rapids and caught the boat and then landed on the shore and picked up Mr. Spencer and continued on our way. As to whether the boat was detached at any place in the Desplaines river itself, I will say, no. It might have been detached from the boat to take Mr. Spencer a little closer to the shore. It was not detached by the action of the current.

As to the size, the width and the draught of this boat, the Mississippi, I believe is about 35 feet long outside of the paddle wheel, which I believe is about a six foot wheel in diameter. The beam is about 8 feet inside. The cabin fits very close to the gunwale. The draught I judge to be between 15 and 18 inches. The floor was built close to the bottom of the hull. The cabin extended above the top of the hull about five feet. The control was in the pilot house, both as to the steering apparatus and the machinery. It was registered and I think it was about ten ton burden.

Being asked whether in my employ with the Sanitary District, I have had occasion to consider the navigable capacity of rivers, I would say, not so much for the Sanitary
2211 District as in a private capacity. As to what experience I have had in that line, I will say, I own and operate a transportation company on the Illinois river. As to my experience in owning and operating that transportation company in reference to navigation, I will say I have had occasion to notice the physical conditions along the upper Illinois river, where I operate these boats.

Q. Basing your answer upon the various trips which you have made on the Desplaines river from its mouth to Dam No. 1 at Joliet, including the trip you made on August 13, 1909, what would you say as to the condition of the Desplaines river today between these points, as being a navigable or non-navigable stream?

Objected to, as incompetent, irrelevant and immaterial; no foundation has been laid; and that it is immaterial what the condition of the river is at this time.

The WITNESS. I would say that it was a navigable stream; there are some other points on the river that some little diffi-

culty might be encountered. For instance, at the Rock Island bridge, at the City of Joliet. Being asked, if I experienced any difficulty with bowlders on the trip of August 13, 1909,
I will say, no, none at all. We did not make any effort
2212 to avoid them. We just followed what I considered the
channel of the river that I had gone over a good many times.

Cross-Examination by Mr. Scott.

Being asked, whether Mr. McCormick told me that he would like to see whether a power boat would go down that river, I would say, my best recollection is that it was all of two years before we took the trip. As to how long the boat had been at Joliet before we took the trip, my best recollection is that it was four or five days before we transferred the boat into the Desplaines river before we made the trip. As to how long the boat had been on the canal, the Illinois and Michigan canal before we made the trip, I should say it had been in the canal and the Illinois river for Mr. Spencer's use for four or five weeks before we made the trip. Previous to that time the boat was in the service of the Sanitary District in transporting the survey parties from the headquarters at Chillicothe to Kingston Mines, and Savannah, to where the survey work was being prosecuted. It was in that service immediately before it was brought up the canal. The boat was not
brought from Muscatine, Iowa. It had been in my serv-
2213 ice for over a year continuously. It was brought up to
Joliet in the canal. I am unable to state how many days Mr. Spencer was using it. He used it between the date of that letter, about July 6th or 7th, up to the time the boat was taken up the I. & M. canal to be transferred into the Desplaines river; but just what length or how many days he used it I am unable to say. It was transferred into the Desplaines river just previous to our making the trip. How many days previous, I am unable to state. We were transferring the boat several days, three or four days I believe. It was transferred on skids from the canal down into the river.

Being asked if before the party came down, the party referred to in the testimony today, was the boat operated in the Desplaines river at all, I will say it had never been into the Desplaines river to my knowledge. As to whether from the time we put it from the canal into the river until the

party came down, was it operated at all, I would say
2214 I understood so; I understood that they ran the boat from where we transferred it into the Desplaines river, up to McDonough street. I was not there and have no personal knowledge of that; from the time I left the boat in the Desplaines river I didn't see it again until we came to McDonough street and found it at that point. Being asked whether any operation of it prior to the time I found it at that point is not within my personal knowledge, I will say no. I might make a correction there; the boat was operated in the Desplaines river above dam No. 1, just passed through the locks and went up the river some little distance and laid at the wharf. That is where the river is part of the canal.

Being asked whether I said that the painter of the boat parted in the rapids, I will say, yes, in the Dresden Heights rapids. As to how the boat was recovered, I don't quite recollect that; but the painter parted and we found our boat drifting away and we ran down some distance toward the Kankakee river, and my recollection is that we turned around and picked up the boat and then landed on the
2215 shore to pick up Mr. Spencer. I mean that we picked it up from the launch and not from the land; I am satisfied that is correct.

Being asked if I myself ever made any measurements of this boat, I will say, just from being on it possibly a hundred times, I gave my testimony as to the length and width and height. Being asked whether I made any measurement with any instrument, except my eye, I will say, no. As to its draught, the only measurement I made was from seeing
2216 it out of the water, and seeing the water line above the bottom of the hull. I did not make any measurements; not with a rule.

I operated a transportation company on the Illinois river, called the Starved Rock Ferry Company. As to what boats were used by that company, I will say there are two boats; one 50 feet long, 10 foot beam, 38 horse power, heavy duty engine, stern paddle wheel. The other is 36 feet long, 8 foot beam, operated with a stern paddle wheel, 21 horse power heavy duty engine. One launch 30 feet long, about 6 foot beam with a 37 horse power engine. And then there are several barges and a quarter boat, the living boat in connection with it. Those boats operate between Ottawa and the lower Illinois river. As to how long they have been oper-

ated there, I will say last year was the first year I operated them. As to how long prior to that they were operated, I will say, they are a new outfit I had constructed. Being asked whether my first experience with this transporta-
2217 tion company dates back to last year, I would say, in the outfit that I personally own, yes.

Q. In the outfit that you personally own?

The WITNESS. Yes, sir, I have been operating boats ever since I have been ten years old.

COUNSEL FOR DEFENDANT. I move to strike out the answer beginning "I have been operating boats," and to the end, as not responsive to the question.

The WITNESS. As to what time last year did I acquire this transportation company, I will say, I acquired it over a year ago. I bought some barges that were operated on the Hennepin canal and rebuilt them, and those passenger boats were built for me at Grafton, Illinois, steel hulls. I first established one boat at Starved Rock the 1st of May. The other two boats were established in June some time. As to what does the Starved Rock boat do, I will say, they were all used by the Starved Rock Ferry Company. Starved Rock is the location of the headquarters of the company. They do a general ferry business across the river and an excursion business from Ottawa down to the lower Illi-
2218 nois river. We run a regular ferry there at Starved Rock. As to how many of the boats are employed on that ferry, I would say all three of them at times. As to the nature of the river at the point where that ferry is, I would say, there are two channels. There is an island directly in front of the Starved Rock grounds. The south channel I judge is about 250 feet wide; and the north channel about 300 feet wide, approixmately. The depth varies with the stage of water, but we do run in about 18 inches of water at times. As to what boat do we run in 18 inches of water, I will say, both are stern wheel boats. Being asked if that is the low stage, I will say, yes. As to what the ordinary stage of water is during the period we operate boats, I will say between Ottawa and Starved Rock I don't know of any time after the 1st of June to the 15th of September that on the bars we have more than three feet of water, unless there was a freshet that lasted possibly 24 hours. Being asked to state when I saw the boats operate

on 18 inches of water at that place, I will say there
2219 were several times last year. The gauge records were kept at Starved Rock and at Ottawa. These points where we had 18 inches of water were on the bars between Ottawa and Starved Rock. As to what kind of bottom is on those bars, I would say, both sand and rock with boulders. There is considerable sand at different points, and there are many boulders, especially at what is known as the Horse Shoe Riffles. The Horse Shoe Riffles are less than a mile above Starved Rock, opposite what is known as Massacre Island. They are on the course of our ferry. As to how the water at that point last summer compared with the water shown there on the profile of 1901, I couldn't say. Being asked whether I made any measurements to ascertain that there was but 18 inches of water there at the time I now refer to, I will say I know that one of my boats, the War Chief, draws about 18 inches of water, and going over those bars we scratched the bottom; that is the way I judge there
was about 18 inches of water. Being asked if it was
2220 in midstream that they scratched the bottom, I will say, yes, we followed the channel, the deepest point in the stream. Being asked if I will describe that point so it can be located by the profile as closely as possible, I will say I think possibly the profile would show the location of the Horse Shoe Riffles, or Horse Shoe Canyon. The Horse Shoe Riffles are less than a mile above Starved Rock. Our boats operate on the lower Illinois for excursion business. It is not by any schedule—just for charter. As to how far down do they operate, I would say as far as anyone wants to go. We have some patrons that desired to go to St. Louis and we were ready to take them but they didn't care to pay
the price. We didn't operate that far down. As to how
2221 far down we operated them I will say we made one trip to La Salle with passengers; we made that trip quite often. That is about seven miles below Starved Rock by rail and about nine or ten miles by water. The character of the river between Starved Rock and La Salle is mostly a sand bottom and quite shallow. As to the slope, I should say off hand about a foot and a half or two feet slope. Being asked whether that is to the mile, I will say, no, all the way down. Being asked whether for the seven miles, is that not a very slight slope, I would say, there is considerable slope at different points. It is not uniform. As to what the high-

est slope is between those points, I am unable to say exactly.

I should judge there is four or five tenths of a foot
2222 within a few feet, at the Illinois Central and C., B. & Q.
Railroad bridge. Being asked if that was the maximum slope, I wouldn't say that. As to where the maximum slope is and what it is, I will say, it depends entirely on the condition of the tributaries and whether there is a flood stage or a low water stage. Being asked to take an ordinary stage during the period of navigation, then what is the greatest slope, I would say, just from recollection that the slope that I gave was correct as the normal. Being asked what the maximum is, I will say I don't know what the maximum is. I wouldn't like to say. In high water my judgment is that it is greater. When I say that in my opinion the Desplaines river is a navigable stream, I mean that it can be navigated in the same manner that I navigated it with the "Mississippi." As to whether I mean that it can be used for useful purposes of commerce, as commerce is usually conducted upon streams, I will say, yes, I believe it is a navigable stream in the sense that you speak of it.

I can suggest some improvements, of course, in a stream
2223 of that nature that would assist navigation to some extent. As to whether in my opinion it was a navigable stream in this sense, that it is navigable for useful purposes of commerce, as commerce is usually carried upon a stream I will say I think it is; I think it can be made use of. As to whether, in my opinion, it is now, I will say, well, I haven't any boat that could navigate over the riffles at Dresden Heights. If some apparatus was rigged up to pull a boat over those riffles, then I believe I have boats that could navigate the rest of the Desplaines up to Brandon's bridge. As to that distance from Brandon's bridge up to dam No. 1, I wouldn't want to try to navigate a boat under the Rock Island bridge with the structure built as it is, and present conditions. Being asked to assume that the Rock Island bridge was out of the way, then would it be navigable for useful purposes of commerce from the Rock Island bridge or from Brandon bridge up to dam No. 1, I will say I think

then it is only a matter of power. I think the boats
2224 can be operated if you get sufficient power to propel them against that current. Being asked what current, what do I refer to when I say "that current," I will say, there is more current from dam No. 1 down to McDonough

street bridge than there is below that point. As to what is the difference between the height or clearance of the Rock Island bridge and Brandon's bridge, I think there is more clearance at the Rock Island bridge than at the Brandon bridge. A boat which could go under the Brandon bridge could go under the Rock Island bridge. Being asked whether any effort was made to take the Mississippi from McDonough street bridge up to dam No. 1, I will say, no, I wouldn't undertake it. The abutments set diagonally across the stream, and there is no way you could turn such short corners with a boat. As to a current such as that, I will say, it would be very difficult if there was not a current. You would have to back around and have plenty of sea room in order to put a boat through that angle. The width of the span at the Rock Island bridge is not over 80 or 90 feet; that is my best judgment. Being asked whether I left
2225 the boat when the others did, I will say, yes, at Marseilles. We then proceeded to Ottawa by electric car and afterwards went to Chillicothe. I did not return to the boat, the Mississippi. I didn't see the boat again until it reached Chillicothe. I think it was about ten days afterwards. As to whether an effort was made to bring the Mississippi up the Desplaines river, I will say, no, except from Marseilles to the point where it was transferred into the I. & M. canal up to what is known as Sugar Island. Sugar Island is about three miles below Morris.

The "Mississippi" was brought up to a point three miles below Morris, because the river and the I. & M. canal come close together at that point, and we didn't have so far to carry the boat on skids.

2226 Q. Endeavored to take it over by the river?

The WITNESS. That point was selected for the reason that it was the easiest point to transfer the boat to the I. & M. canal.

COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive to the question, and I will ask that the question be read to the witness.

(Question read.)

The WITNESS. No, sir. Being asked, was I there, I will say, no.

Q. All you know about that is what has been told you?

The WITNESS. I expect they followed my instructions.

COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive to the question.

Q. All you know about that is what has been told you?

The WITNESS. I gave instructions that that was the point that I desired to have the boat transferred.

COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive to the question.

Q. All that you know about that is what they told you?

COUNSEL FOR GOVERNMENT. I object to the question; the witness is not obliged to answer in the words of counsel.

COUNSEL FOR DEFENDANT. Of course, but he is obliged to answer, and he has not answered the question.

The WITNESS. I asked them whether they transferred it at that point, and they said they did. Being asked whether that is all I know about it, I will say, that is all I know about it. Being asked how I know that the Mississippi could not go up the Desplaines, I will say it could have gone up to the Dresden Heights riffles, or rapids. That is in the Desplaines—at the mouth of the Desplaines. It could not go up above that. There is no way the Mississippi could pass those rapids without rigging up something to put her through, on account of the current being too swift. Being asked as to how long I have known those rapids, I will say, since March, 1901. As to whether I have ever known a time when the Mississippi could have gone up them, I will say, I think possibly the Mississippi could have made the trip through the Dresden Heights rapids before the dam was
2228 started. I think that is a possibility. I have navigated through there a good many times day and night. Nothing like the Mississippi, but if the Mississippi had a little more power—

Q. Did you ever with a power boat of any kind navigate up that river?

The WITNESS. No, but I am satisfied if the Mississippi had a little more power, I think it would have done it.

COUNSEL FOR DEFENDANT. I move to strike out beginning with "but I am satisfied" to the end of the answer as not responsive to the question.

Being asked whether at any time I navigated up the Desplaines river with a power boat, I will say, no. As to whether at any time I ever navigated the Desplaines river with a power boat except this one trip, I will say, no. As to whether at any time I navigated that stream with any boat propelled by any sort of power except oars, except this one trip, I will say, no. Being asked whether I ever navigated it in

any kind of a boat except a row boat, except this one trip, I will say, I think we stuck up a sail at one time in
2229 Lake Joliet, in a row boat. Being asked whether I was with President McCormick when he made the historical trip on this river, I will say I have never been in the Desplaines river with him. As to whether I have ever been capsized on the Desplaines river, I will say, no. Being asked whether I ever towed a row boat up from the mouth of the river, from the Illinois into the Desplaines and up the Dresden rapids, I will say, I did not start down quite at the mouth; I started at a point a short distance above that and rowed up several miles. Being asked, what point that is, I will say, the Kankakee feeder. That is above the rapids. Being asked if I ever at any time went from the mouth of the Desplaines river in a row boat up to Joliet, I will say, no. Being asked if I ever went from the Kankakee feeder in a row boat up to Joliet, I will say, no. As to how far up I did go when I started from the feeder that time, I will say, I went up to Jackson creek, and that is above the Kankakee feeder—about three miles. And below Joliet
2230 about 12 miles. Being asked if I ever went up Treat's Island in a row boat, I will say, yes. I don't recollect now whether I ever passed the Millsdale bridge, but I have often rowed from Jackson's creek at Alexander's up to Millsdale—up to the bridge, but whether I passed through and under that bridge I have no recollection at this time. I have often rowed up stream above Treat's Island towards Joliet, starting I would say, above Treat's Island. I have no recollection of going under the Treat's Island bridge. I recollect rowing against the stream at all points along the Desplaines river from Brandon's bridge down to the mouth, except a short distance from the mouth up stream to the feeder aqueduct and under the Treat's Island bridge. Up to the head of Treat's Island, I have no recollection of ever having attempted that. Being asked whether I have ever
2231 rowed from Brandon's bridge up to dam No. 1 on the Desplaines river, I will say, no. As to the character of the river above Brandon's bridge to dam No. 1, I will say, there are several small islands in the river, some boulders around these islands, and I believe the bottom of the river through that section is gravel. What the slope is per mile I am unable to say. As to the current, it would be simply an approximation. Being asked whether I stated

in my direct that I had navigated the river about 25 times from Joliet to the mouth, I will say, yes, at different times in setting high water marks and in reading gauges and in making surveys along the Desplaines river. I did not mean that I had gone up and down the length of the river 25 times. As to whether I have been on the river at various points about 25 times, I would say I have navigated the full length down about 25 times.

2232 I have been on the river hundreds of times, beginning about McDonough street and going down to the mouth of the river. A good many times I have gone from dam No. 1 down. As to whether I have gone 25 times down to the mouth of the river and through the Dresden rapids, I will say, yes. As to whether every time I went down I went over the rapids, I will say, no. As to how many times I have been from dam No. 1 down to McDonough street, I only recollect one trip that I made from the dam down to McDonough street. That was in July or August of 1902 or 1903. The occasion of that trip was, I followed a line of floats all the way from the Bear Trap Dam at Lockport to St. Louis on the Mississippi. When I made the trip from dam No. 1 to McDonough street I used a row boat; used a row boat all the way down to La Salle, and from

2233 that time on we used a launch. With me in the row boat there were two or three people.

As to whether there are a number of launches at Joliet, I will say, there are at this time, yes. Being asked whether I have ever known of any launch going down the Desplaines except the Mississippi, I will say, I didn't know of any boat —I don't know of any boat that has ever made the trip before to my own knowledge. As to whether I ever heard of anybody making it, I will say, yes, I have heard of boats navigating the Desplaines river, but it is a matter of history. I don't know anything about it. Being asked whether within my own knowledge I have ever heard of any launch going down that river, I will say, I have not, no. Being asked if I have ever heard of launches going down, I will say, I have heard of steam launches, steam and power launches do operate in the river above the dam at Joliet, in the I. & M. canal. Being asked whether in the river,

2234 where the two are coincident, the canal and the river, I will say, my understanding is that the launches at Joliet operate in the I. & M. canal down to a summer resort

at Rock Run. I don't know of their passing above dam No. 1. There are many boats from Chicago that pass down through the I. & M. canal and pass through that section of the river. As to whether, if they wished to get into the river at Joliet, they could do so readily with those boats, I will say, there is now way of getting in without dropping them in with skids the way we put ours in. There are a great many of them smaller than the Mississippi and more readily put into the river.

As to whether I know how the painter happened to break when we were going through the rapids, I would say, it was a small quarter-inch rope; I suppose there was a sudden jerk which broke it. The boat did not capsize. As to whether I was looking at it when the thing happened, I will say, if it had capsized I would have known it when I picked it up, that is the reason I say it did not capsize. Being asked to look at photograph No. 4179 and say when that was
2235 taken; what the boat was doing at the time, I will say, this is at a point just below the Dresden rapids. As to whether the boat was leaving the Dresden rapids or backing at the time that picture was taken, I will say, it was leaving the Dresden rapids. The Mississippi did not have power enough to back up against that current. Being asked if she is not in that picture backing against the current, I will say it would be utterly impossible to say what she was doing there. The wheel is stationary; the wheel is not moving. Being asked if I don't see the splash from the wheel, I will say, no, I don't. Being asked if I don't see the water flowing on that paddle, I will say no; that could be the wash against the turn of the boat from the rapids. I see the position of the row boat with relation to the position of the steamer pressed up against it. That illustrates absolutely that the boat is not backing up. If that launch was backing up, the row boat would be turned around the other way and the stern would be up towards the bow. It is absolutely impossible that that boat is backing up. That picture would indicate that the boat was turning around.

2236 Being asked to look at 4180, and say whether I see the row boat in that, I will say I see what appears to be the row boat. I think it is.

Being asked whether this picture, 4179, was taken after 4180, 4180 showing the row boat free in the stream and in the rapids, and 4179 showing it up against the stern of the

steamer, I will say, no. My opinion is that 4179 was taken first and that the boat broke loose shortly after this time and then this picture was taken showing the boat drifting down. That is the rapids right there. They extend over some little distance. Being asked whether the picture is marked "Leaving the rapids," and if it isn't apparent from the picture itself that it is just opposite the rapids, I will say, it is perfectly apparent to me that it is in the rapids. Being asked if I was watching the stream to let Mr. McCormick know when it would be a good time to go down, I will say, not any more than I generally do. It was a
2237 good time, we were taking these pictures along the I. & M. canal and I had no other use for the boat at that time and transferred it into the Desplaines river so that he could make the trip. This trip was contemplated for a long time.

Being asked whether I knew Hickory creek pretty well, I will say, I am acquainted with it to some extent.

Q. How far up Hickory creek could you have taken the Mississippi at that time?

Objected to, as not proper cross-examination. The question of Hickory creek being not involved in this case. We don't have to prove every stream in Illinois is navigable.

The WITNESS. I am satisfied I could not have gotten very far up the creek. As to how far up I think I could have gone, I will say it is quite narrow there at the mouth and I don't know as I could have navigated the Mississippi in that creek. As to how far I think I could have taken it up the DuPage river, I think about half a mile. As to how far I could have taken it up Jackson's creek, I should say about five hundred feet. There is a barbed wire fence runs across the creek at that point. If there were not any barbed
2238 wire fence at that point, I could have taken it up possibly one hundred feet farther. As to why I could not go more than one hundred feet farther, I will say because the creek becomes shallow and narrow.

Re-direct Examination by Mr. Cressy.

Being asked whether I was asked on cross-examination concerning the condition that existed at the site of the cofferdam of the Economy Light and Power Company at the

mouth of the river, and what was the condition which existed there prior to the erection of the cofferdam, I would say, that the condition so far as current and depth of water was concerned, was about the same as at Smith's bridge, and the Whitmore riffles at the mouth of the DuPage river. As to how far across the river does the cofferdam of the Economy Light and Power Company extend, proportionate to the width of the river, I should say that about two-thirds of the river had been shut off. As to whether at the time the cofferdam was put in the Economy Light and Power Company blasted out considerable portions of the river bank on the south bank of the Desplaines river, I will say that I don't know.

2239 *Re-Cross Examination by Mr. Scott.*

Being asked if I know that they blasted out a considerable portion of the bank on the south and east side, I will say, no, I do not; I have absolutely no information on the subject. Being asked whether I observed it before the operations of the Economy Light and Power Company and since, I will say, yes. Being asked whether I observed no difference between the bank on the south now from what it was prior to the operation of the Economy Light and Power Company, I will say, now since you have spoken of it, I seem to recollect that there is a change there, but to what extent I am unable to say. As to whether from my observation, the bank on the south has been removed to a very considerable extent by the Economy Light and Power Company's operations, that I couldn't say. Being asked if the river extended in that direction, I couldn't say so, no. I said prior to the operations of the Economy Light and Power Company in the building of the cofferdam, I thought the rapids were about the same at Smith's bridge and Whitmore riffles, that is my judgment.

2240 As to how far you could hear the roar of the rapids at Dresden Heights before the cofferdam was built, under ordinary atmospheric conditions, I will say I haven't any recollection of hearing those rapids. I imagine there were times when there would be a stiff wind blowing up against the rapids, that the waves would create a noise that you might hear some distance; but I haven't any recollection of hearing them now. It is my opinion that the rapids at

Dresden Heights before the operations of the Economy Light and Power Company and the building of the cofferdam were practically no greater than those at Smith bridge and at the Whitmore riffles. I don't know there was very much difference.

Being asked if I have ever read the reports of engineers as to the physical conditions of the river prior to the time the Economy Light and Power Company built a cofferdam there, I will say I haven't any recollection of reading anything in connection with those riffles, no, sir. Being
2241 asked if I know that those rapids were very much swifter and steeper than those at Smith bridge before the Economy Light and Power Company operations there, I will say no. It is my opinion that they were no greater than those at Smith bridge. I think the conditions were about the same.

Re-direct Examination by Mr. Cressy.

As to how many times I examined the conditions of the rapids at the mouth of the Desplaines river where the present cofferdam of the Economy Light and Power Company is erected prior to the erection of the cofferdam, I will say in passing over those rapids and through those rapids at least 25 times I have made general observations.

Re-Cross Examination by Mr. Scott.

Being asked if I know what the fall to the mile is at
2242 the rapids at Dresden Heights, I will say, no, I don't.

As to whether I know what the fall to the mile is at the rapids I have spoken of at Smith bridge and Whitmore riffles, I will say no. As to whether that would have some bearing on the relative cross sections of the two falls, I will say, yes, in connection with the area of the stream.

LYMAN E. COOLEY, heretofore called as a witness on behalf of the Government, resumed the stand and further testified as follows:

Redirect Examination by Mr. Cressy.

COUNSEL FOR GOVERNMENT. I desire to offer in evidence as rebuttal to the questions asked Mr. Cooley in reference to Colonel Chittenden's paper, a paragraph from page 265 of the Transaction of The American Society of Civil Engineers, Vol. 62, as follows:

> "In the flood of 1906 in Western Washington, which did enormous damage and stopped railway traffic for upward of two weeks, the crest of the flood occurred about the 15th of the month. The month of October had been very wet, and the ground and forest storage was exhausted."

Q. Referring now to the original paper of Colonel Chittenden and to the questions put by counsel for defendant in reference to the alleged disagreement between Colonel Chittenden and yourself, you may state how Colonel Chittenden's views may be distinguished from your views, and any factors which Colonel Chittenden has failed to take into account in discussing the question of deforestation.

Objected to; that the disagreements or agreements
2254 between Mr. Cooley and Colonel Chittenden will appear from the testimony of Mr. Cooley as to facts and the statements as to the same facts by Mr. Chittenden; that the conclusion of Mr. Cooley is not competent.

COUNSEL FOR GOVERNMENT. I will say that for the purpose of saving the record we offer the testimony of Mr. Cooley with the privilege for counsel for the defendant to introduce any part of the paper of Colonel Chittenden which may show that Mr. Cooley's conclusion is not well founded.

COUNSEL FOR DEFENDANT. The objection stands.

The WITNESS. Colonel Chittenden's paper deals specifically with the proposition that in great river basins extremes of high and low water are not materially affected or not affected at all by forests and other operations of man. With this proposition I take no issue as a general proposition and have already referred to that view of the matter on the former cross-examination.

In the paper itself Colonel Chittenden fails to recognize properly the functions of permeable ground which to my mind is a major function in the whole question of runoff and the regulation thereof by natural forces. He also fails to take note of the frozen ground condition which is responsible for a great many floods, which reduces the surfec of the ground to an impermeable surface and which is almost wholly absent under forest cover. Colonel Chittenden does
2246 not distinguish also the difference in the consumption of water by different kinds of cover which to my mind is a matter of importance. While he recognizes the forest cover affects usual conditions and had a regulative influence thereon, he does not give proper value in his conclusions to the continuity or the usual stages of water as compared to the extremes; and finally he does not recognize the effect of forests in humid regions upon snow fall, or distinguish its action there from what occurs in the semi-arid regions of the far west. As to whether the memorandum I am now using was prepared by myself, I will say, it was. Being asked who Mr. Collingwood was, I will say, Mr. Collingwood is a man who has been active in his profession; for a large part of his professional life he was connected with the Brooklyn bridge. Later with the University of New York, having virtually retired for a number of years, and was looked upon as one of the able men of the profession:

COUNSEL FOR GOVERNMENT. Referring to page 319 of the paper, the discussion of F. Collingwood, I desire to read in evidence a paragraph from that page as follows:

"The author grants that, in periods of drought, springs and streams dry up more completely when a country is deforested, which is another way of saying
2247 that forest do, in a measure, regulate the runoff. As bearing upon this point, it was the writer's good fortune, about fifty years ago, to listen to a series of lectures by the noted geologist, Professor James Hall. He stated that, in his memory, the removal of the forests from large sections of the State of New York had resulted in drying up a large portion of the springs formerly so abundant. This was especially noticeable in the removal of the watering troughs which had been so numerous along the public roads. This coincides with the writer's memory as to Chemung County, in that state."

Also the next paragraph:

"The next point controverted by the author is that forests regulate the flow by retaining snow, which slowly melts at a later period, and thus replenishes the streams. In reply to this: the writer well remembers that, in the woods on the hills near Elmira, N. Y., the drifts remained unmelted long after every bit of snow had disappeared from the cultivated portions of the valley. It was a common remark that there was enough left to add perceptibility to the flood usually expected in June. Exposure and the kind of forest may have had something to do with this, but the fact remains."

Also on page 231 the following paragraph:

"To the writer's mind, the cause is very plain. One of the streams heading into the Chemung is very steep, and when the heavy woods were out of its bank, the flood-waters were more rapidly concentrated, and poured
2248 into the main stream, so that the time required for the flood from a heavy rain to reach Elmira was very much shortened. The writer's recollection is that this time was reduced to one-half. The other two streams did their quota of damage, but not to the same extent. If this be true, the conclusion is irresistible; that the forests do act as powerful conservators and regulators of stream flow.

The conclusions seem sound, from another point of view: Here is a stream flowing for centuries, having a uniform regimen, with fairly uniform section and smooth banks up to, say 50 years ago, showing, up to that time but few signs of destruction from floods. Within 20 years there is a complete change, and a beautiful stream is transformed into an irregular, wilful, destructive

If the cutting of the timber did not do it, what was it?"

Q. What can you say as to the position taken by Mr. Collingwood in reference to the paper of Colonel Chittenden?

Objected to the conclusion as incompetent, immaterial and irrelevant. I also object to the reading of these excerpts unless the entire article from which they are taken is put into the evidence.

2249 COUNSEL FOR GOVERNMENT. I will say that for the purposes of saving the record, these excerpts are taken by

way of rebutting the contention made by counsel for the defendant on cross-examination.

COUNSEL FOR DEFENDANT. I insist it is not rebuttal, or fair rebuttal, to take excerpts which do not fairly represent the attitude of the writer in question.

COUNSEL FOR GOVERNMENT. If counsel for the defendant desire, they are at liberty to offer other portions of the paper.

COUNSEL FOR DEFENDANT. We will do so. I understood you also to say that it was not rebuttal, but was a part of your main case. At the same time I wish it understood when I say that we will do so, that I do not withdraw the objection which I make to this manner of introducing the evidence.

(Question read.)

The WITNESS. I think Mr. Collingwood's position is sound and he has illustrated it by his knowledge and experience which cannot be gainsaid.

COUNSEL FOR DEFENDANT. I move to strike out the conclusion of the witness as to whether the thing can or cannot be gainsaid.

COUNSEL FOR GOVERNMENT. Just a moment; will you please read the question again?

(Question read.)

Q. Does he agree with Colonel Chittenden or disagree with Colonel Chittenden?

2250 The WITNESS. He disagrees. Being asked whether I have got those lists of people who disagreed or agreed, that I was asked about on cross-examination, I will say I have it noted on the margin of my paper here.

COUNSEL FOR GOVERNMENT. May I look at that a moment?

The WITNESS. Yes. (Handing paper to counsel.)

The WITNESS. As to whether I was asked on cross-examination at page 1754 in reference to Mr. Thomas P. Roberts, and whether I stated that I knew Mr. Roberts and that Mr. Roberts has a good reputation, I will say not personally, I know him by reputation.

2251 COUNSEL FOR GOVERNMENT. I will offer in evidence the following from page 323:

Objected to in that it cannot be rebuttal to a question. There was no answer given by Mr. Cooley which could be rebutted except as to his knowledge of Mr. Roberts. I further object that it cannot be rebutted by selecting a particular paragraph if there were anything to rebut.

COUNSEL FOR GOVERNMENT (reading):

"It appears that Colonel Chittenden must be correct

in his assumption that, for the extremes of high floods and low water, as observed in our navigable rivers, forests exert no appreciable control. For the intermediate or what might be termed summer freshets, there is apparently some reason to think that forests have a measurable influence in reducing their height and prolonging their discharge, and this statement may hold, notwithstanding that less rainfall reaches the earth in forests than in open country."

Q. What bearing has this paragraph that I have just read in reference to the questions put to you by counsel for defendant, as to the alleged disagreement that exists between Colonel Chittenden and yourself, as to the effect of deforestation?

Objected to, that the bearing of the paragraph is not to be determined by the opinion of this witness as to its bearing.

The WITNESS. It is an admission by Colonel Chitten-
2252 den and by Mr. Roberts that forests do exercise control at intermediate stages of water under usual conditions.

Q. Referring to Mr. Stephen Child, Mr. Cooley, what position did he take in this discussion of Colonel Chittenden's paper?

Objected to, as it appears from Mr. Child's paper, and that is the only competent evidence.

The WITNESS. Mr. Child did not discuss the merits of the paper, but expressed the wish that Mr. Chittenden should be answered by somebody competent to do so.

Q. Referring now to L. J. Le Conte, what position did Mr. Le Conte take in reference to the discussion of Colonel Chittenden's paper?

Objected to, as it appears from Mr. Le Conte's paper, and that is the only competent evidence.

COUNSEL FOR GOVERNMENT. We ask these questions for the purpose of saving the record; if anything contrary appears in the paper, counsel is at liberty to introduce any portion of the paper.

COUNSEL FOR DEFENDANT. It is not a question of whether anything contrary appears in the paper; in this particular instance it is asking the conclusion of the witness as to
2253 the position taken, and it is objected to on the ground that the contents of a paper cannot be proven by anybody's conclusion as to what they are when they are written in language anybody can understand.

The WITNESS. Mr. Le Conte expresses his general agreement with Colonel Chittenden, but does not discuss the paper as a whole, contenting himself with a relation of his experience respecting dew fall in the San Joaquin valley, California. Being asked if I know Mr. Le Baron, I will say I know Mr. Le Baron personally and by reputation. As to his standing as an engineer, I would say he has had a considerable experience in New England and a large experience in the tropics, and at the present time is in British Columbia engaged in engineering work.

COUNSEL FOR GOVERNMENT. I will offer the paragraph on page 335, as follows:

Objected to as incompetent, immaterial and irrelevant, and on the same grounds that have been given for reading extracts from those who discussed the paper.

COUNSEL FOR GOVERNMENT (reading):

"The author states that the action of the forest to moderate the run-off and mitigate the severity of freshets fails entirely in heavy and long precipitation. He admits that the humus and debris in forests retain precipitation and act as a reservoir for a time, but eventually
2254 may become saturated and thenceforth will be of no value for that purpose. In an extensive forest this impounding capacity is very great, and by just so much it reduces the peak of the run-off or at least the first part of the ascending curve, and there is no proof that, by the time the forest reservoir is full, the peak of the flood may not be past.

In his third proposition, the author says that 'while small springs and rivulets may dry up more than formerly, this is not true of the larger rivers.' If there were no springs, rivulets, or brooks, there would be no rivers and, if these all run dry, the large streams must run dry also."

Q. What position does Mr. Le Baron take in reference to Colonel Chittenden's paper?

Objected to that the question is incompetent, immaterial and irrelevant; that the conclusions of the witness are absolutely of no value or materiality as to the positions taken when the positions appear in the work that lie before counsel; and further, having read from the paper which is prepared by Mr. Le Baron the position that he takes, it is manifestly useless to cumber the

record with the conclusions of the witness in regard to that.

COUNSEL FOR GOVERNMENT. These questions are asked merely because of the questions asked on cross-examination by counsel for the defendant.

2255 The WITNESS. He disagrees with Mr. Chittenden.

Being asked what the standing is of Mr. Edward P. North as an engineer and forestry expert, I will say, Mr. North has a high standing and has experience in the west and also in the east; has practically retired for some years past. A man whom I know personally and was associated with in the investigation of the Erie Canal expenditures under the nine million act of 1898.

Q. Does Mr. North agree or disagree with Colonel Chittenden?

COUNSEL FOR DEFENDANT. The same objection stands.

The WITNESS. He disagrees.

Q. You were asked on cross-examination: "Then you do not know that he contributed to that discussion and agreed with Mr. Chittenden," referring to Mr. A. Miller Todd, page 1752; and you answered, "I don't know." Have you since examined Mr. Todd's discussion, so that you are prepared to answer that question.

The WITNESS. I have. He did not agree with Mr. Chittenden. His position was neutral.

2256 Being asked if I am acquainted with Dr. George Otis Smith, I will say I know him by reputation but not personally. He is the head of the United States Geological Survey, and has a very high reputation. He is quite a young man yet.

COUNSEL FOR GOVERNMENT. I will read in evidence from page 363.

Objected to as incompetent, immaterial and irrelevant, and on the same grounds that have been given for reading extracts from others who discussed the paper.

COUNSEL FOR GOVERNMENT. I will begin in the middle of the pagraph at this point (reading):

"The ability of the forest bed to delay run-off is admitted by Colonel Chittenden, who considers it likely to aggravate floods, in the logic of which deduction, however, the writer cannot follow him—at least this aggravation of flood conditions certainly cannot be regarded as an 'unquestionable tendency of forests.' Rather this retarding action of the forest mulch will tend to increase

the proportion of the rainfall contributed to the underground reservoir, thus reducing the amount immediately converted into run-off."

2257 Q. That paragraph appears as part of Doctor Smith's paper, does it not?

The WITNESS. It does.

COUNSEL FOR GOVERNMENT. Referring to page 364, I will read as follows:

COUNSEL FOR DEFENDANT. The same objection stands.

COUNSEL FOR GOVERNMENT (reading):

"The author's view, that delayed melting of snow is not beneficial, must also be challenged. While the writer too has found dry ground beneath a dwindling snow bank on digging into the sand he has discovered the water beneath. Again, it seems probable that the bottom, as well as the top, of the snow cover is also a melting surface both in the open and in the forest. This is shown by the manner in which certain spring flowering plants penetrate the snow wherever the cover becomes thin. Thus it appears reasonable to believe that the time of snow-melting is a period of contribution to the underground flow, and the total contribution from snow is necessarily largest where conditions favor the longest period of melting."

Q. What position does Doctor Smith take in this discussion of Colonel Chittenden's paper?

Objected to. Doctor Smith speaks for himself and his paper is here.

The WITNESS He disagrees with Chittenden.

2258 COUNSEL FOR GOVERNMENT. I offer in evidence the first paragraph on page 368 of the paper of George F. Swain.

COUNSEL FOR DEFENDANT. Objected to; Mr. Swain speaks for himself and his paper is here.

COUNSEL FOR GOVERNMENT (reading):

"The Society should be grateful to Colonel Chittenden for the interesting paper which he has presented, and for the able and forceful way in which he has discussed the question of the effect of forests and reservoirs on stream flow. His remarks are so well presented that upon a first reading those who believe in forest preservation might feel that their side of the case had received a severe blow, but a careful examination disclosed many apparently contradictory statements, whilst the argu-

ment seems quite as conjectural and the specific statements quite as much without proof as those given by the writers with whom the author disagrees. As a matter of fact, he seems to admit most of which is claimed for forests. So far as his paper may be considered a protest against extreme views, the writer agrees with him, though many of his statements are extreme in the other direction, and are certainly unsound."

Q. What is the standing of Professor Swain, among engineers, in reference to forestry matters?

The WITNESS. Professor Swain is professor of engineering at Harvard University, and has had a long career; well known to engineers and considered a very able man.

2259 COUNSEL FOR DEFENDANT. You will note that in your examination, Mr. Cressy, you asked about Professor Swain and got a different statement as to what his position is. I will just call your attention to that now, because you may wish to make some correction. He may have looked it up since. I am reading from page 1855 of the record. I should judge he had looked it up, because he said he didn't know so much about this Swain, but he did know a good deal about his father. Look at the bottom of the page. He says:

"Professor Swain has been connected with the Washington School of Technology, I think, and it was his father who was the inventor of the Swain turbine, for a long time connected with the water power development of New England. I do not know so much about this Swain, except that he has an excellent reputation."

The WITNESS. Being asked whether I have looked up in reference to Professor Swain since the prior examination, I will say, I have. As to whether I desire to correct or

2260 change the statement made at the prior examination, I will say where the record says "Washington School of Technology" the word "Washington" is an error, the record should read Boston School of Technology.

COUNSEL FOR GOVERNMENT. I will also offer in evidence from Mr. Swain's paper the following paragraph on page 366.

COUNSEL FOR DEFENDANT. The same objection stands.

2261 COUNSEL FOR GOVERNMENT (reading):

"The author first considers the relation of forest to stream flow, and states that:

'The commonly accepted opinion is that forests have a beneficial influence on stream flow:

(1) By storing the waters from rains and melting snow

* * * preventing their rapid rush to the streams and paying them out gradually afterwards, thus acting as true reservoirs in equalizing the run-off.

(2) By retarding the snow-melting in the spring and prolonging the run-off from that source.

(3) By increasing the precipitation.

(4) By preventing erosion of the soil on steep slopes and thereby protecting water courses, canals, reservoirs and similar works from accumulations of silt.'

This will probably be admitted to be a fair statement of what the believers in the benefits of forests consider to be true, except that some do not think there is yet sufficient demonstration that they increase the rainfall, although the writer believes that they do."

Also from Professor Swain's paper the following paragraph 369.

COUNSEL FOR DEFENDANT. The same objection stands.

COUNSEL FOR GOVERNMENT (reading):

"The general aspect of this part of the subject seems,
2262 after all, very simple. The forest floor absorbs a large amount of water, prevents it from flowing off rapidly, and pays it out gradually into the soil, through which it finds its way to springs and to the underground water. If the land were clear of vegetation, or if it were cultivated, and especially if the slopes were steep, the erosion under heavy rains would be great, and might leave no soil upon the rocks to serve as a reservoir in future storms. The author's argument, therefore, leaves unassailed the beneficial effects of forests in regulating flow: and the illustration used by Mr. Pinchot seems a reasonable example of a usual phenomenon."

Also from page 371 of Mr. Swain's paper, the following:

COUNSEL FOR DEFENDANT. The same objection stands.

COUNSEL FOR GOVERNMENT (reading):

"To January 1st, 1900, the State (referring to the French Government) had acquired, for the purpose of controlling torrents, 162,974 hectares (about 407,000 acres), and had expended upon the work of protection more than 66 million francs, with a further contemplated expenditure of more than 114 million francs, and one of the most recent writers on the subject states: 'the role of the forest as regulator of the flow of streams may be considered as evident, and it is today universally admitted.'"

Q. What is Professor Swain's standing, in reference to the discussion of Colonel Chittenden's paper?

Objected to as incompetent, immaterial and irrelevant; that his position appears from his paper and cannot be established by the testimony of this witness.

The WITNESS. He disagrees with Colonel Chittenden. As to whether Mr. Leffingwell and Mr. Strong wrote separate papers or a joint paper, I will say they wrote a joint paper. Being asked what I can say as to Baily Willis and his standing as an engineer, I will say Mr. Willis is a geologist connected with the United States Geological Survey, and has had a very broad experience in his particular line of business.

COUNSEL FOR GOVERNMENT. I will read in evidence from Mr. Willis' paper, beginning at the beginning of the paragraph on page 386.

Objected to, as incompetent, immaterial and irrelevant, and on the same grounds that have been given heretofore for reading extracts from those who discussed the paper.

2264 COUNSEL FOR GOVERNMENT (reading):

"Statistics of comparative run-off from bare and forest slopes, which are observed in such a way as to yield data for close comparison, are not known to the writer. It is probably safe to say that they have not been observed in the United States. To obtain them, one must observe the same precipitation on adjoining areas, of like slope, soil and geological structure. Only in this way can the forest influence be isolated, and its effect ascertained statistically. The writer, however, has before him the results of three years' investigation by Professor L. C. Glenn, of Nashville, Tenn., in the Southern Appalachians, the most critical region of the United Sstates, and has gathered from Professor Glenn's manuscript report to the Forest Service the following summation of details which bear on this question.

Forty-six creeks and small rivers, the water-sheds of which may be described as timbered rather than cleared, are known, according to observation and local repute, to rise gradually in times of flood, to continue high for several days and to subside slowly. They carry but little sediment, and they maintain a good volume of water during dry seasons.

Thirty-eight creeks and small rivers in the same watersheds, having slopes which may be described as cleared

rather than timbered, are known, according to observation and local repute, to rise rapidly in times of flood to
2265 extreme flood height, to carry excessive quantities of mud, sand and gravel, and to fall quickly. In dry seasons they are very low, and the range from lowest to highest stages has increased, and has inflicted much damage in very recent years."

Also from page 389, the following paragraph.

COUNSEL FOR DEFENDANT. Objected to as incompetent, irrelevant and immaterial, and on the same grounds that have been given for reading extracts from those who discussed the paper.

COUNSEL FOR GOVERNMENT (reading):

"Thus the writer's conclusion, based upon experience of snow conditions ranging from the mountains of North Carolina to the glaciers of Mount Ranier, in that the forest does exert a beneficial influence in retarding the melting and run-off of snows, even though, as happens in certain areas, the snowfall is so great as to produce floods in spite of the forest's influence."

Q. What position does Mr. Willis take in the discussion of Colonel Chittenden's paper?

Objected to that it is not the best evidence; that the position is to be determined from the paper itself.

The WITNESS. He disagrees with Colonel Chittenden.

COUNSEL FOR DEFENDANT. And that it is the repetition also of his testimony on the last hearing that these men disagreed.

The WITNESS. Being asked what I can say as to the standing of Mr. Leighton as an engineering and forestry expert, I will say Mr. Leighton has come into very great notice
2266 in the last few years on account of his proposition respecting reservoirs in the Ohio river basin. He is connected with the United States Geological Survey, I believe with the Bureau of Stream Measurements.

COUNSEL FOR GOVERNMENT. I will read also a paragraph from Mr. Leighton's paper on page 401.

Objected to as incompetent, irrelevant and immaterial, and on the same grounds that have been given for reading extracts from those who discussed the paper.

COUNSEL FOR GOVERNMENT (reading):

"It is true, as Colonel Chittenden states, that a drift in the open in the high Sierras and Rocky Mountains remains long after the snow in the forest is gone. There is a reason for this, which is peculiar to such country. This is not always true in the lower countries, Colonel

Chittenden's experience in Western New York to the contrary notwithstanding. Inasmuch as the author has referred in an attractive way to his experience as a boy on the farm, the speaker will assert that he, too, 'was once a bare-foot boy,' and that in the woods of Maine when he desired to find snow in June or July, he went to the forest, as did other boys. In the open country crops were approaching maturity at that time."

COUNSEL FOR GOVERNMENT. Referring to the paper of Mr. Pickett, I will offer in evidence from that paper the paragraph beginning at the bottom of page 425.

2267 Objected to as incompetent, irrelevant and immaterial and on the same grounds that have been given for reading extracts from those who discussed the paper.

COUNSEL FOR GOVERNMENT (reading):

"In carefully reading Colonel Chittenden's views as to snow-melting, the points wherein he differs from the writer may admit of explanation. While conceding that snow melts faster in open areas, the author claims that when the snow in forests commences melting it goes faster than if in open areas. In the timber belt this does not hold good in June, July or the first weeks of August. The snow in the forest that softens on top, or perhaps partly melts is crusted over or frozen at night, so that the melting or softening is not resumed until noon or later the next day."

COUNSEL FOR GOVERNMENT. I also offer in evidence from the paper of Mr. McMath a paragraph given on page 437.

Objected to as incompetent, irrelevant and immaterial, and on the same grounds that have been given for reading extracts from those who discussed the paper.

COUNSEL FOR GOVENRMENT (reading):

"The author in the first of his seven summing up propositions, says: 'The bed of humus and debris that develops under forest cover retains precipitation during the summer season, or moderately dry periods at any time of the year, more effectually than do the soil and
2268 rocks of deforested areas similarly situated.' The writer is content to accept this statement as the grand averaged fact, and thinks it a verdict in favor of forests."

The WITNESS. Being asked what I can say in reference to Mr. McMath's reputation as an engineer and forest expert, I will say he has one of the highest reputations of any man in

the United States respecting the physics of rivers. I have known Mr. McMath personally for twenty-five years.

COUNSEL FOR DEFENDANT. I here interpose an objection to the witness suggesting to the counsel question that he would like to have him ask him. I would state that Mr. Cooley suggested this last question, although the record may not so show.

COUNSEL FOR GOVERNMENT. Referring to Mr. Labelle, have you read his discussion of Colonel Chittenden's paper?

The WITNESS. I have.

Q. What would you say as to Mr. Labelle's position in reference to the paper of Colonel Chittenden?

Objected to, on the ground that the evidence is not competent; that the paper speaks for itself and is present here.

The WITNESS. I should say that Mr. Labelle is quite uncertain as to his position upon the subject matter under discussion, and I put him down as neutral, waiting for further light.

COUNSEL FOR GOVERNMENT. I offer in evidence from page 443, from Mr. Labelle's paper, the following paragraph.

2269 The objection heretofore made stands.

COUNSEL FOR GOVERNMENT (reading):

"In his 5th proposition the author gives an important place to second growth; there is no doubt that second growth in Eastern forests tends to perpetuate or at least restore the conditions obtaining before the removal of the virgin forest, whether these conditions be favorable or not to the uniformity of stream flow. In the Southwest, however, in places, coniferae compose the bulk of the forests, and deforestation leaves the country as bare as the bluffs of eastern Nebraska. On some of the hills, where thick forests existed 25 years ago, not a tree nor a bush can be seen; the second growth, owing no doubt to the scarcity of rainfall, has not materialized; there is almost no gross and the ground is bare and sunbaked. Still the erosion is not remarkable from year to year and is almost entirely confined to the stream beds. It is true to say, however, that floods have more violence now than before deforestation."

The WITNESS. Being asked whether I am acquainted with Emil Kuichling, and if I know his standing as an engineer, I will say, I know Mr. Kuichling personally. He has a very high standing upon this class of questions and prepared

2270 the report of the Water Supplies for the State of New York in connection with the barge canal, which is now under construction.

Q. What position does he take in reference to Colonel Chittenden's paper?

Objected to, on the ground that the evidence is not competent; that the paper speaks for itself and is present here.

The WITNESS. He takes the position that the subject matter has not been sufficiently investigated in this country and does not discuss the paper. I put him down as neutral.

Being asked what Mr. Robert Fletcher's standing is as an engineer and forestry expert, I will say I only know of Professor Fletcher by reputation as professor of engineering at Dartmouth College.

COUNSEL FOR GOVERNMENT. I offer in evidence a paragraph on page 449 of Mr. Fletcher's paper.

Objected to as incompetent, irrelevant and immaterial and on the grounds that have been given heretofore for reading extracts from those who discuss the paper.

COUNSEL FOR GOVENRMENT (reading):

"The moderating and equalizing influence of forests on the run-off of ordinary rainstorms is a fact too obvious to be questioned. We must not, however, belittle the absorbent and retentive power of tillage and grass land under proper conditions of cultivation and slope."

Also paragraph labeled Paragraph 4 on the same page.

2271 Objected to as incompetent, immaterial and irrelevant, and on the same grounds that have been given heretofore for reading extracts from those who discuss the paper.

COUNSEL FOR GOVERNMENT (reading):

"The author's proposition concerning the effect of forests on snowfall to aggravate the flood discharge of rivers is not true in this region. Snow always remains in the woods late the spring (except among young deciduous growth on the south exposure), and disappears gradually during April and May. Furthermore the ground in the wood freezes much less than in the open, and probably in spots allows percolation of water from the snow more or less throughout the winter; for, in the reservoir under observation, the surface lavel has been known to rise throughout the winter, notwithstanding the draft upon the reservoir. (A temperature of 20

degrees below zero is commonly experienced during three months of the winter.)"

Q. You were asked on cross-examination in reference to Mr. Fletcher. Page 1748, as follows: "Do you know that he agreed with Mr. Chittenden in all these conclusions," and you answered, "Yes, I think I know that." I will ask
2273 you as to whether you have carefully read Mr. Fletcher's paper, and ask you whether you desire to explain your answer in reference to Mr. Fletcher's agreeing with Colonel Chittenden or not?

Objected to on the ground that the evidence is not competent, that the paper speaks for itself and it is present here.

The WITNESS. He agrees with Colonel Chittenden on one point and that is with reference to extreme floods in the woods; but on other points he disagrees with Chittenden or does not express an opinion. On the whole I should say he disagrees with Chittenden.

Q. The paragraphs which I have already read into evidence show do they not ,that disagreement?

Objected to; the paragraphs speak for themselves.

The WITNESS. They do.

COUNSEL FOR GOVERNMENT. The agreement with Colonel Chittenden is expressed by the following paragraph (reading):

"The author's second proposition is quite confirmed by the writer, who has tramped for miles over the drain-
2273 age area of the reservoir in the height of heavy rainstorms, and found the saturated woodland shedding the rainfull in swift and furious streams, even more rapidly than the meadows where grass was growing."

Is that correct?

The WITNESS. That is correct quotation, but I would observe in respect to that quotation—

Objected to, the witness volunteering what is not asked of him.

COUNSEL FOR GOVERNMENT. In answer to the objection of counsel I will say that I have requested Mr. Cooley to examine very carefully all the papers which were presented on this discussion in view of the cross-examination of counsel for the defendant.

COUNSEL FOR DEFENDANT. I am glad you have said that; and I would like to ask you to go a little farther. Did you ask

him to examine the papers and find out what was said by the several writers on each side?

COUNSEL FOR GOVERNMENT. Yes, sir, I did.

COUNSEL FOR DEFENDANT. Very well, I am glad to know that.

COUNSEL FOR GOVERNMENT. That is, in so far as to ascertain whether or not they agreed or disagreed with Colonel Chittenden in view of the questions put by counsel for the defendant.

COUNSEL FOR DEFENDANT. Let me put in a little fur-
2274 ther, taking one of those for instance, who is said to disagree, in making extracts did you ask him to be fair about it and give extracts on both sides from those writers, or only such as would conflict with what Colonel Chittenden said?

COUNSEL FOR GOVERNMENT. In case where they agree with Colonel Chittenden in part and disagree in part, I have requested the witness to point out those passages. I have already introduced one of them to show that point.

COUNSEL FOR DEFENDANT. I simply wanted to know what the instructions to the witness were before I cross-examined him. You understand that that was what Mr. Cressy desired, did you, Mr. Cooley?

The WITNESS. Yes, sir.

COUNSEL FOR GOVERNMENT. I do not, however, offer in evidence all the passages in reference to the points of agreement with Colonel Chittenden, because I have simply offered the ones that I have shown.

COUNSEL FOR DEFENDANT. I then move to strike out all the extracts read, on the statement of counsel that he instructed the witness to examine in reference to passages on both sides; that he has not introduced the passages whoich were in support of Mr. Chittenden, but only those that he has seen fit to introduce. I make the motion on the ground that no
2275 such selection of passages can fairly represent the papers or the attitude of the writers of the papers.

COUNSEL FOR GOVERNMENT. Counsel for defendant is at liberty to cross-examine and introduce any other passages that they may desire, as bearing upon their case.

COUNSEL FOR DEFENDANT. Counsel for the defendant says that he does not know of any rule of law that permits a counsel to select what he pleases from written documents, and leave to the other side the burden of putting in the rest, or to

cross-examine to see whether those put in fairly represent the document itself.

COUNSEL FOR GOVERNMENT. Let the record show that in answer to the objection of counsel that the paper of Colonel Chittenden and the discussion in reference thereto was not introduced by counsel for the Government on direct examination, and we simply introduce this testimony by way of rebuttal of the position taken by counsel for the defendant.

COUNSEL FOR DEFENDANT. Nor was it introduced by counsel for the defendant. It was referred to simply as showing disagreement among eminent engineers upon matter upon which Mr. Cooley has testified.

COUNSEL FOR GOVERNMENT. I desire to offer in addition to what has already been offered from the discussion of Mr. Pinchot, the following paragraph upon page 459.

2276 Objected to as incompetent, immaterial and irrelevant, and upon the same ground that has heretofore been given for reading extracts from those who discussed the paper.

COUNSEL FOR GOVERNMENT (reading):

> "In certain regions where there is a very thick humus, reaching occasionally, as in the Adirondacks, a depth of 3 feet, it has an important storage capacity; but the capacity of the humus is always insignificant compared with that of the ground. The mountains themselves are the chief reservoirs, and the principal function of the forest, so far as water is concerned, is to keep the surface soil permeable, so that these reservoirs of ground water may be regularly and bountifully replenished. When the importance of the forest to ground storage is once realized, a very large part of Colonel Chittenden's argument is seen to rest on a fundamental misconception."

Q. Now referring to the closing paper of Colonel Chittenden I will ask you if you have examined that since the last hearing in reference to picking out certain passages in that testimony which shows that there was not a disagreement between yourself and Colonel Chittenden as alleged by questions put to you by counsel for the defendant.

2277 The WITNESS. I have.

Q. Is the paper which I now hold in my hand a paper which you have prepared showing that?

The WITNESS. It is.

COUNSEL FOR GOVERNMENT. I will thereupon read in evidence the first passage marked by Mr. Cooley.

Objected to that that implies a question is asked, whether these are the passages which he picked out which show something.

COUNSEL FOR GOVERNMENT. The passages speak for themselves.

2278 COUNSEL FOR DEFENDANT. That is what I have been insisting all along here. I object to the reading of passages picked out for a particular purpose, that purpose being to establish a conclusion as to whether there is a disagreement between Mr. Cooley and somebody else; on the statement of the witness as to the principle upon which he has picked them out, I object that it can be nothing other than a conclusion. I object further that it is incompetent to pick out from this paper certain extracts and read them with a view to having it appear that they fairly represent the view of the author, or the agreement or disagreement of the witness with the author.

COUNSEL FOR GOVERNMENT. If the passages picked out do not fairly represent the position of Colonel Chittenden on these matters, counsel for the defendant is at liberty to introduce other passages.

COUNSEL FOR DEFENDANT. The question is further objected to since it is predicated upon alleged statements in the cross-examination of the witness as to disagreements between him and Colonel Chittenden. It does not refer to or specify what these statements as to the disagreements in the cross-examination were, and so far as I am now able to discover no question was put in which any reference was made to a dis-

2279 agreement between Colonel Chittenden and this witness.

COUNSEL FOR GOVERNMENT. I will thereupon read in evidence the first passage marked by Mr. Cooley. Page 471 of Mr. Chittenden's closing paper:

> "Of course there can be no dispute over the fact that the forest bed, wherever it exists, has a storage capacity, and why Mr. Leighton now says it has not, is a mystery. If he had said that such capacity is greatly overrated in the popular estimation, he would have been entirely correct, but that it does exist to some extent is not to be questioned, and in certain situations it is quite large."

Also from page 483:

> "What the writer did say in elucidating this subject

was: 'When a period of heavy storms occurs, spreading over a great area, continually increasing in intensity the forests by retaining some portion of the earlier showers and paying them out afterwards do produce a general high condition of the river which may greatly aggravate a sudden flood from some portion of the watershed.' "

Page 488 the following paragraph:

"In fact, it is growing evident, as this matter is looked into more carefully, that the forest, in more ways than one, is a voracious consumer of water during periods of drought, and that it is not at all the source of low water supply that it has been held to be."

2280 Page 505:

"This paper had 'particular reference to navigable rivers,' and its general conclusions must be read with reference to our large streams."

Page 512:

"Professor Swain has cited Professor Carpenter on the subject of snow melting. The writer has often drawn upon the ample fund of information which Professor Carpenter has accumulated, and has conferred with him on more than one occasion. It is a pleasure to bear testimony to the value of his opinions upon any subject."

Page 513:

"Mr. Willis states that the forest prevents from 20 to 40% of the rain from reaching the ground, depending upon conditions. The range is far wider than this. In the heat of summer, and with light showers, forests often hold back nearly 100% of precipitation; but when it comes to cold, heavy rains, from 1 to 3 in. in a day, and in deciduous forests where, for large portions of the year, there are no leaves on the trees, will any one venture to say that the forests prevent even 1% of the rain from reaching the ground? Yet it is with these very extremes, as the writer has pointed out with emphasis, that our practical problems in river control are concerned.

The writer would request those interested in this discussion to read carefully the quotation given from Ernst Ebermayer early in Mr. Willis' discussion. It is a plain
2281 case of being unwilling to swallow one's own doctrine. If that quotation means anything, it means that the for-

est prevents rain-water from penetrating the ground as readily as in the open country. But 'the forest on the mountain differs very decidedly from that on the plain in regard to water control,' and 'a factor is introduced through which wooded mountain slopes receive a much larger amount of water than bare unwooded watersheds.' What is the factor? What is the difference between mountain and plains forests in regard to water control? The writer maintains that, so far as there is any difference it is all in favor of the plains forests. For the same forest bed the retentive capacity diminishes as the slope increases. Anyone can verify this fact by experiment. Far from the mountain forest being more effective in resisting run-off, the exact opposite is the truth. This example affords a pointed illustration of the straits to which forestry advocates are often put in trying to square the direct and necessary consequences of their reasoning with a conventional theory which they are reluctant to oppose."

Also from page 516:

"Dr. Smith makes what seems to the writer an essentially sound statement of the function of the forest mulch when he says that it 'acts as a temporary reservoir of limited capacity, but it contributes its stored waters downward as well as outward.' This is the
2282 writer's position exactly, although he may differ from Dr. Smith as to the relative quantities that go outward and downward under varying conditions. The writer, however, dissents in the general case from the further view that cultivated land does not store and transmit precipitation to the ground as effectively as does a forest soil otherwise similarly conditioned."

Q. Referring now to the closing paper of Mr. Chittenden, what can you say by way of comment with reference to the answers made by Colonel Chittenden to the points brought out in the discussion of his first paper bearing upon the question of the effect of deforestation upon stream flow?

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. I should saw that the final paper makes clearer Mr. Chittenden's real position, and that he does not differ essentially from the consensus of opinion of the authorities upon such matters with respect to the ordinary effect of forests; and the differences whatever exist are matters of degree rather than of kind. The paper, as he has stated,

is specifically directed to the contentions which have been made of considerable or material effects in regard to
2283 extreme floods in large river beds, which is not germane to this matter.

Referring now to the question of the comparison of the Desplaines river with the River Rhone, referring to the book entitled: "The Improvement of Non-Tidal Rivers," and especially to the article by L. Jacquet, chief of engineers of the Ponts et Chaussees, which I believe has already been introduced and identified, I will say that article contains a description of the slopes and velocities found upon the River Rhone; in an article by M. Jacquet, engineer in chief of the River Rhone, contained in this translation by Colonel William E. Morrell, I have picked out certain paragraphs from that article.

Q. Will you please read those in evidence?

Objected to as incompetent, immaterial and irrelevant, and further on the ground that the entire article is not offered.

COUNSEL FOR GOVERNMENT. In answer to the objection by counsel for the defendant, I will say if there are any other parts of this article that he desires to introduce, we will be very glad to introduce them, but to save the record we simply offer certain passages. Now, will you proceed with your answer?

2284 The WITNESS. On page 35, the first paragraph, if you will read it to save my eyes.

COUNSEL FOR GOVERNMENT (reading):

"Between Lyons and the mouth of the Isere the low water discharge is about 8,123 cubic feet. The mean slope is 30 inches per mile between Lyons and St. Vallier, 47.2 miles, and 35½ inches between St. Vallier and the Isere, 17.4 miles.

From the mouth of the Isere to the mouth of the Ardoche, a distance of 54 miles, the low water discharge is about 11,830 cubic feet, and the mean slope per mile is 50 inches.

From the Ardeche to Soujean, a distance of 52.8 miles, the slope per mile varies from 32 to 16 inches."

The next reference, page 68, paragraph 2.

(Reading): "It can, therefore, no longer be denied that the low water slope of the Rhone has not an approximately uniform value of from 1½ to 3¼ feet per

kilometer, but that the slope forms upon the bars or ripples a series of marked falls where it varies from 9 to 20 feet per kilometer."

The WITNESS. I want to say that 9 to 20 feet per kilometer would be at the rate of 15 to 33-1/3 feet per mile.

COUNSEL FOR GOVERNMENT. The next reference is page 117, paragraphs 2 and 3 (reading):

2285 "The mean velocity in the pass will then be only 5½ feet. This velocity is very slight for the Rhone. It is less than that which navigation finds in various natural passages, and it can very easily be overcome by the present boats of the company.

At the stage of 11½ feet above low water, the highest at which the river is navigable, the flowing section is 7,250 square feet, and the discharge of the Rhone is then 56,505 cubic feet, the mean velocity will then be 7.8 feet, which will be very acceptable at this stage of water, seeing that the Rhone at this stage has, naturally, velocities of 10 feet in mid river, and 23 feet under certain bridges."

The next reference is page 153, paragraph three (reading):

"Thus, in some deep pools the slope becomes exceedingly small; sometimes, on short lengths just below rapids, we even find a counter slope on the surface; while on the rapids themselves the slope is great, and sometimes amounts to 1 foot in 200. The low water line is composed of an alternation of gentle and steep slopes, corresponding to pools and bars."

The WITNESS. One foot in 200 is the equivalent of 26.4 per mile.

COUNSEL FOR THE GOVERNMENT. The next reference is page 160 (reading), foot note:

2286 "These boats which are peculiar to the Rhone, are thus described by Mr. Malezieux in his Cours de Navigation: 'In ascending the Rhone from Avignon to Lyons, a distance of 187 miles, it is customary to employ large towboats called "grappins," which, besides the usual paddle-wheels, carry a wheel in the forward part of the boat whose circumference is armed with projecting prongs. This wheel which is from 10 to 13 feet in diameter, is placed at the end of a hinged frame, and it drops down through an opening in the middle of

the hull, and by its own weight rests on the bottom of the river. It is then set in motion by the boat's engine, with the help of a chain and chain wheel; its prongs, penetrating into the sandy bed of the river, cause the boat to advance. The axle can rise or fall as the depth of water varies. This wheel, however, is only used to cross bars where the current is very strong; elsewhere the submerged wheel is raised and thrown out of gear, and the paddle wheels are used."

The WITNESS. I can give the lengths of the Rhone from this book. On page 31, the length of the River Rhone from Lake Geneva, Switzerland, to the mouth of the Saone at
2287 Lyons is known as the Upper Rhone, and it has a length of 132.1 miles. From the mouth of the Saone at Lyons to Arles, which is known as the middle Rhone, it is 174.6 miles. From Arles to the sea, which is known as the Maritime Rhone, is 31 miles, making a total length from Lake Geneva to the sea of 337.7 miles. This is information which I have summarized from what appears on page 31.

Q. What is the elevation of Lake Geneva?

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. Lake Geneva is 1,230 feet above the sea.

Q. What is the elevation of the mouth of the Saone at Lyons?

Objected to as incompetent, immaterial and irrelevant.

The WITNESS. From Lyons to the sea is about 500 feet, as nearly as I can estimate.

COUNSEL FOR GOVERNMENT. At a previous examination we asked leave to make certain corrections in the table furnished by Mr. Cooley entitled: "Number of days at which the Riverside gauge stood at or above certain elevations." In twenty-four years, from 1887 to 1910, inclusive, because of the fact that gauge readings as furnished to us by the
2288 Sanitary District did not exactly correspond with the gauge readings as later certified to by the Sanitary District, we have now offered in evidence the certified readings of the Sanitary District, and we have made the correction in this table which appears at pages 1395 and 1396.

We offer in evidence a revised table, and also an amendment showing the corrections from this table over the one offered on page 1395.

2289 (The documents so offered in evidence are in the words and figures following, to-wit):

NUMBER OF DAYS AT WHICH THE RIVERSIDE GAUGE STOOD AT OR ABOVE CERTAIN ELEVATIONS IN 20 FULL YEARS, FROM 1887 TO 1910 INCLUSIVE.

(a) Elevation at or above 18.0 ft. corresponding to the crest of Spillway, at elevation 16.25 ft. and an elevation of 13.6—14.0 ft. at Summit and a volume of 4500 second feet.

(b) Elevation at or above 13.8 ft. corresponding to the crest of Ogden-Wentworth dam at elevation 11.73 ft. and a volume of 1052 second feet.

(c) Elevation at or above 13.0 ft. corresponding to original Chicago Divide at Elevation 10.5 ft. (Summit) and volume of 600 second feet.

(d) Elevation at or above 12.4 ft. corresponding to elevation 9.6 ft. at Summit in "12-Mile Level" and volume of 305 second feet.

(e) Elevation at or above 11.85 ft. corresponding to volume of 100 second ft. and elevation 8.8-8.9 ft. in "12-Mile Level."

(f) Average daily run-off for the year in second feet.

Year	Precipitation at Chicago Inches	(a) 18.00 ft. C. D.	(b) 13.80 ft. C. D.	(c) 13.00 ft. C. D.	(d) 12.40 ft. C. D.	(e) 11.85 ft. C. D.	(f) Average Daily Run-off. S. F.
1887	29.13	5	65	88	175	260	
1889	34.95	0	34	60	107	168	
1893	27.47	5	59	89	114	162	
1894	27.46	3	38	65	103	149	
1895	32.38	1	15	21	35	84	
1896	33.14	0	12	35	122	216	
1897	25.85	9	76	96	134	162	
1898	33.77	6	45	58	93	194	
1899	26.49	0	25	42	91	139	
1900	28.65	0	31	41	104	194	305
1901	24.52	5	25	31	38	236	350
1902	37.57	1	68	116	169	225	504
1903	28.09	6	64	85	151	242	607
1904	26.14	11	51	62	79	118	579
1905	35.36	4	32	55	111	219	370
1906	30.87	2	48	96	131	175	416
1907	35.10	5	93	155	194	254	757
1908	34.83	5	80	104	131	172	
1909	43.22	5	63	94	143	186	
1910	26.86	6	38	69	125	168	
Total 20 yrs.		79	962	1462	2350	3723	3888
Avg.	31.09	3.95	48.10	73.10	117.50	186.15	
Average 8 years							486

Note:

The average precipitation for the 28 yrs. 1843-1870 is 34.66 in.
" " " " " 40 " 1871-1910 " 33.52 "
" " " " " 68 " 1843-1910 " 33.99 "
" " " " " 8 " 1900-1907 " 30.79 "

2291 THE REVISED RECORD
1905-10
FROM CERTIFIED COPY OF GAUGE READINGS
OF
THE SANITARY DISTRICT OF CHICAGO
WITH
CORRECTED AVERAGES FOR THE TWENTY YEARS, 1887-1910.

Year	Precipitation	a	b	c	d	e
1905	35.36	4	32	55	111	219
1906	30.87	2	48	96	131	175
1907	35.10	5	93	155	194	254
1908	34.83	5	80	104	131	172
1909	43.22	5	63	94	143	186
1910	26.86	6	38	69	125	168
Total 20 years.		79	962	1462	2350	3723
Average	31.09	3.95	48.1	73.1	117.5	186.15

2292 We also offer in evidence a certified copy of the high water marks between Bridgeport and Summit, rise of June, 1892; also the high water marks on the Desplaines river, Summit to Joliet, rise of June, 1892.

COUNSEL FOR DEFENDANT. I object to them to unless all the high water marks taken by the Sanitary District are in their possession at any point from the Chicago river, or between Lake Michigan and the Desplaines river are also introduced in connection with them.

COUNSEL FOR GOVERNMENT. In answer to the objection of counsel, I desire to state that these are the high water marks which were introduced in evidence here on the re-direct examination of Mr. Cooley and objected to as not being properly certified to.

COUNSEL FOR DEFENDANT. At that time I made like objection to the objection I am now making.

COUNSEL FOR GOVERNMENT. Further in reference to the objection of counsel, we will say that they are offered to substantiate the high water line as set forth upon the exhibit entitled Parry Exhibit 2.

COUNSEL FOR DEFENDANT. And the objection is made because they cannot correctly set it forth or give its true meaning unless the high water marks to the east of that line are also produced, and we are unable to understand why the United States should not produce them.

COUNSEL FOR GOVERNMENT. Let these be marked Cooley Exhibits 6 and 7.

2293 COUNSEL FOR DEFENDANT. And I make the further objection that no proper foundation has been laid for their introduction, and that the facts should be made to ap-

pear by persons having actual knowledge of the observations at the time or by other authentic proof.

COUNSEL FOR GOVERNMENT. In view of the fact that these contain a lot of data, is it necessary that they be copied into the record?

COUNSEL FOR DEFENDANT. I am making no stipulation as to those, Mr. Cressy, until I get everything that relates to this question.

(Which said documents, so offered in evidence, were marked respectively, "Government Exhibit Cooley, 6 and 7.")

2294 *Re-direct Examination (Continued) by Mr. Cressy.*

COUNSEL FOR GOVERNMENT. I have a map I want to introduce by Mr. Cooley and Mr. Parry before you start in with the cross-examination.

The WITNESS. The map now shown me is a profile of the Chicago divide between the west fork of the Chicago river and the Desplaines river at Summit, on a scale of 10 feet to the inch vertical and two miles to the inch horizontal. It shows the existing conditions as they were in the survey of 1890; the high water line of 1892; the portage road as shown on the topographic map Kramer Exhibit No. .....; and a red line drawn thereon from the crest of the Ogden dam over to a point above the Chicago divide at eleva-
2295 tion 11.1 which is taken to be the limit below which boats could no longer pass over the Chicago divide. It also showed certain hypothetical lines as the extension of the profile of the flood of 1892 over the original divide at elevation 13.72 and extended down to Hoyne avenue on the west fork at 11.6.

It also shows the hypothetical bottom of the little canal described by Long and Phillips and Graham across the Chicago divide. This was a map prepared under my direction, by Mr. Thomas F. Parry.

COUNSEL FOR GOVERNMENT. I will withdraw Mr. Cooley from the stand at this point and ask Mr. Parry to again take the stand.

(Witness withdrawn temporarily.)

THOMAS F. PARRY, heretofore called as a witness on behalf of the Government, resumed the stand, and further testified as follows:

Direct Examination by Mr. Cressy.

Being asked to look at the map before me and to state if I prepared this map under the direction of Mr. Lyman E. Cooley, I will say I did. As to the maps or other data that I used in the preparation of this profile, I will say it is
mainly made from the topographic map of the Sanitary
2296 District of 1890-1892; the surveys of the ground shown
at Mud Lake and all, is gotten from that map, taking the north arm where Ogden ditch is located clear to the Desplaines river. The portage road elevations were all taken from that same map, and the high water of 1892, is taken from the records of the Sanitary District—the records of those elevations as taken at that time. The bottom of the Ogden ditch, and the bottom in 1890, is mainly taken from Captain Marshall's report and map. The dotted lines as credited below; the gutter, or little canal, and the projection
of the high water, is the projection of the plane as
2297 shown over the divide to the break in that divide.

Being asked to look at the line marked high water of 1892, and the figures which appear along that line, "End of portage slough, 16.2, Oak Park avenue 15.5, Ridgeland avenue 15.23," and so on; and say where that data was obtained, I would say that was all from the certified data of the Sanitary District of Chicago from observations taken at that time made by Eben, Ward & Cross.

As to whether any other data was used in the compilation of this profile, other than what I have now mentioned, I will say the data clear to the extreme west is from the profile of 1884, of the City of Chicago, the old Chicago Commission. As to how far does that extend, the data obtained from them I will say to the Ogden-Wentworth dam; from the Ogden-Wentworth dam then, to the left. As to any other data that is used in the compilation of this profile, I will say nothing that is not referred to down here; the report of Graham and Phillips shows the foundation for that gutter; and in the report of Stephen Long; that is all. Both of those are specified on the profile itself.

COUNSEL FOR THE GOVERNMENT. We offer this profile in evidence and ask to have it marked "Parry Exhibit 3."
2298 (Said profile so offered in evidence was marked "Government Exhibit Parry 3," and appears in the Appendix, p. .....)

Cross-Examination by Mr. Scott.

Being asked whether I said that the bottom of Ogden ditch, and the bottom of 1890, is founded mainly upon Marshall's survey, and whether it is founded on anything else, I will say, yes, I looked over the cross-sections made by the Sanitary District and by old surveys made by the Commission, the Chicago Commission. As to whether I examined any Government surveys showing the bottom of the Chicago river prior to 1890, I will say I looked at Captain Marshall's report, no other. Being asked whether I have them in arriving at this bottom of Ogden ditch, and the bottom of 1890, recourse to other matter than that that appears in the Marshall survey, have you not, I will say, I don't think so. Being asked whether I mean that the entire line I have drawn there, bottom of Ogden ditch, and bottom of 1890, that the data
2299 for that appears in Marshall's survey, and has been drawn by me without the assistance of any other data, I will say the bottom of Ogden ditch, I am not certain about that. I think—if I had my notes here I could tell. I think I got that from the Sanitary District notes and map, the bottom of Ogden ditch.

Being asked whether I got it all from Marshall's survey, I will say I looked over it. The high water of 1892, that dotted line is an assumed line. The actual line is the unbroken line, H. W. 1892 below. I did not compute that assumed high water line. I put it in there by direction of Mr. Cooley. As to whether I made any effort to ascertain its correctness, I will say I did. I located the relative height of that high water line all through there and noticed where it broke on the new bottom, and assumed that it would break in about the same way as the old bottom, the old bottom being the top of the divide as shown there at 10.5, at about
2300 Kedzie avenue, and broke it at that point. Being asked whether I have not made that assumed high water line break like the actual line at Kedzie avenue I will say I have made that break to come over the high point of land.

The water would maintain its height until over the point of land, a little over.

Being asked whether I am familiar with the bridges in the Chicago river, I will say, no, not particularly. As to whether it would make any difference in the elevation of that point, whether those bridges were or were not there, I would say on that high water not much difference. I don't know that it would make any, the high water runs clear above it.

Being asked whether I know that it would not, I will
2301 say, of course not it would not effect the elevations at that height for that amount of water. I do not know what the sides of the river are used for, or occupied by at that point in the river, and along in that district. Being asked if I know whether or not there are large lumber yards, of considerable extent with large piles of lumber, I will say yes. As to whether or not I know this high water backed into those lumber yards, I will say no, I presume they did; it overflowed the banks. Being asked if I know whether those lumber yards would have had any effect upon the elevation of the water back of them, I will say it flowed over the lumber yards. Being asked if it took them all away, I will say no it didn't take them all away, but floated a large portion of them away. Being asked if I understood what the sides of the river there were occupied for, I will
2302 say I remember the accounts of it at that time, how the boys come in and told about it when they were taking observations.

Q. Would the fact that there were lumber yards there over which this water backed, effect the elevation from what it would have been had there been no lumber yards there?

COUNSEL FOR GOVERNMENT. May I request as to what point you refer to in these questions?

COUNSEL FOR DEFENDANT. I refer to Kedzie avenue and I have never departed from it up to this time.

The WITNESS. Looking at the high water line it don't seem to me to have effected it much.

2304 Being asked how I can tell by looking at the high water line whether lumber yards or bridges effect the high water there at that point, I will say, the high water line at that point comes down to 9:30 at Kedzie avenue and it raised 6/100 to the Bridewell, and then falls off a foot and 7/10 in the next 3,000 feet and that flattening out of the line would seem to be accounted for by the formation at the bottom; it does not seem to have bothered it any.

Q. In answer to my question, you have simply told how a part of the line did actually fall off as measured. Is there anything there to indicate that it would not have fallen off further had there been no obstructions in front of it or in its course?

Objected to as not proper cross-examination and as incompetent, immaterial and irrelevant as to what it might have done.

2305 The WITNESS. I cannot see that it would have fallen off further.

On being asked if it would have fallen immediately to the level of Lake Michigan, had there been nothing to obstruct it, I would say there is the bottom of the river in there.

Being asked what has the bottom of the river to do with the level of Lake Michigan, I would say you didn't say anything about the level of Lake Michigan.

COUNSEL FOR DEFENDANT. Possibly you were not paying attention to the question. Read the previous question to the witness.

(Question read.)

The WITNESS. Sure.

2306 As to what prevented it from doing so, I will say merely that the land was too high between Lake Michigan and the point in question. I mean the land at the bottom of the river. The bottom of the land is the bottom of the river there. Being asked if it fell to the water surface of the river and not to the bottom of the land, I would say yes, it fell to the water surface. Being asked if the water surface was the obstruction by reason of which it did not fall to the level of Lake Michigan, I would say, sure. Any other obstruction interposed between it and Lake Michigan would effect the elevation to which it would fall as to whether that obstruction was in the way of a bridge, abutment, lumber yards, or whatever else interposed itself in the course of the water, I would say it would depend on the height of the freshet.

2307 Being asked if the higher the freshet the more the bridges would interfere with its passage and hold it back, I would say the less it would interfere. An overpowering flood like that ignores the things at the bottom; just goes right over them.

Being asked if it went over the bridges in the Chicago river in 1892, I will say no. As to whether it went between

the abutment, I will say not in every case. It went off in the land on each side of the bridges; overflowed the whole of that part of Chicago, that is for 1892. As to whether it did not overflow the bridges, I will say it did not overflow the bridges but they were isolated in some cases.

Being asked if as a matter of fact the more surface
2308 that opposed its course to the river, the elevation behind that surface would be higher, I will say yes, the higher the water. It would be a cause for maintaining the elevation at a higher level than it would have had there been no such obstructions.

Being asked whether it would not have been important in endeavoring to arrive at the probable high water line as assumed by comparison with the high water line, as measured, to ascertain what if any obstructions there were affecting the elevation of the high water line as congesting its cross section, I will say had those things been taken more into consideration that line would have been higher. The high water line is the hypothetical high water line, which is put in dotted. Being asked if in 1892 it would have been higher, I will say no, not 1892; I am talking about the other one. 1892 is a fixed line. The hypothetical line shows very well there, it is the projection of the high water line of 1892 to the crest of the ground.

Being asked whether that would have been higher if those obstructions had been taken into account, I will say the line
from 13.72 slope line would have been higher if those
2309 obstructions had existed. They were not taken into account because they did not exist at the time that line is drawn for. Being asked how can I say that if they had been taken into account, that line would have been higher, I will say, it would. As to whether they were taken into account, I will say, not that I know of.

Q. If it be true that the high water indicated by that line would have been the higher if the obstructions had been taken into account, it would of necessity be true that the high water of 1892 as actually measured would have been lower if any such obstructions existed, wouldn't it?

Objected to as not proper cross-examination. In view of the fact the witness states that high water line of 1892 is a fixed line.

The WITNESS. Yes. The elevation of the land in the vicinity of Kedzie avenue right at the divide it is about 10.5, at Kedzie avenue about 10.4 there.

Being asked if in the vicinity of Kedzie avenue it
2310 isn't 11, I will say no, it is not. On being asked if I made my drawings on the theory that it is 10.5 I would say, I think it is drawn 10.5. I will get my scale (after scaling) 10.5.

As to what does the map show is the elevation of the probable flood water of 1892 above the divide, I will say a little over three feet. Being asked if I am the same Parry who made Parry Exhibit 2, I will say, yes.

Q. The same point for which you are now giving the elevation a little over three feet you gave in that elevation 1.7 feet, didn't you?

The WITNESS. I don't know whether I did or not.

Q. Look at it and see.

The WITNESS. At that time that that was drawn I had not worked up the high water of 1892 as particularly as I have now. You can see that for yourself.

COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive to the question and I ask that the question be again read to the witness.

(Question read.)

The WITNESS. Yes.

2311 Q. Why would not the high water line assume for 1892 from the divide opposite the Bridewell follow the line actually observed?

The WITNESS. The high water line of 1892 I have put on this old map is not capable of being worked down to these various breaks so as to show it as graphically as in this larger map I have made. This larger profile; this larger scale.

COUNSEL FOR DEFENDANT. I move to strike out the answer as not responsive to the question and I will ask that the question be read again.

(Question read.)

The WITNESS. It does.

Being asked whether the assumed high water line is not about 3½ feet higher than the actual observed line at the point opposite the Bridewell and the Chicago river I would say above the land a little over three feet. As to whether if above the actual observed water service of 1892 I will say there is a difference of four feet.

2312 Q. Why? Would not the assumed high water line of 1892 fall to and follow the actual observed water line of 1892?

The WITNESS. I don't know that I catch what you are driving at.

COUNSEL FOR GOVERNMENT. I think I may straighten that out if I may ask one question.

COUNSEL FOR DEFENDANT. I think the question is clear. Read the question to the witness.

(Question read.)

COUNSEL FOR GOVERNMENT. I think I can save you a lot of questions if I am allowed to ask one at this point.

COUNSEL FOR DEFENDANT. No, I want to hear what the witness has to say. Read the question again.

(Question re-read.)

The WITNESS. I don't catch the gist of that question at all.

Q. What reason is there why the water line assumed should be 4 feet higher than the actual water line as it was observed at that time?

The WITNESS. The reason the high water line maintains itself above the one of 1892 is that the river has been deepened and there is a different place for the high water line of 1892 to break than there was originally.

COUNSEL FOR DEFENDANT. Read that question.

(Question read.)

COUNSEL FOR DEFENDANT. Now read the anwser.

(Answer read.)

The WITNESS. As to how much the river has been deepened, and when, I will say I couldn't tell you that. It
2313 has been deepened 8, 9, 10, 12 feet in places. As to the place where I have put it up 4 feet and how much it has been deepened there prior to 1892, I will say I don't know.

Being asked how can I know how much higher to put the assumed line because the river has been deepened if I did not know how much it had been deepened, I will say that that assumed line is supposed to carry the water over the divide; it certainly had to get over.

As to how far east of the divide the Bridewell is, I will say about half a mile, 2,000 feet.

Being asked, now that we got the water over the divide and a half a mile beyond, or 2,000 feet beyond, why we kept the line up in the air there, I will say the line is not up there in the air at the Bridewell, it is falling off.

Being asked if it is 4 feet higher than the observed
2314 water line, as it actually existed, I will say yes, scant.

Being asked why it is 4 feet higher than the observed water line at that point, I will say because I drew it that way.

Being asked if I can give no other reason why it should be there, I will say that the ground at that time—the bottom of the river at that time so far as there was any bottom of the river at all, ran clear up to plus 10, and fell off gradually at the Bridewell where it is about 8 feet, to down at Robey street where it was only minus a little over 2 feet; the bottom of the river at that time was ten feet above where the bottom is at the present ime. Yes, more than that, 16 feet; the bottom of the river that that water flowed over was 16 feet higher than it is now.

Being asked do I mean that the bottom of the river was 16 feet higher than the bottom of the river is now, I will say yes, than it was in 1890. The river has been dredged and deepened and extended. As to when the bottom of the river
was plus 10, I will say I have answered as to the bottom
2315 of the river there was no river at that time.

Q. Was there no river there previous to 1890?

The WITNESS. There was not.

Q. At what point was there no river?

That is objected to as not proper cross-examination. We did not tender this witness on this branch of the subject as an expert.

COUNSEL FOR DEFENDANT. You tendered him to prove this profile. Now read the question.

(Question read.)

COUNSEL FOR GOVERNMENT. If I may be allowed to interpose one question I think I may be able to save a great deal of cross-examination.

COUNSEL FOR DEFENDANT. I am perfectly satisfied with this cross-examination. Read the question to him.

(Question read.)

The WITNESS. The only river at that point was the little canal across the divide at low water.

As to which point I am now referring to, I will say Kedzie avenue. Being asked about the Bridewell, and not Kedzie
avenue, I will say there was about 4 feet of water there,
2316 under the high water of 1892. Being asked if I mean that the bottom at that time under the high water was

but 3 feet, I will say the bottom of the river from the high water line of 1892 at the Bridewell would have been about 3 feet. As to when it was deepened, I will say it has been deepened at various times. There is the bottom of 1890; it was deepened previous to that.

Q. How long previous to that?

Objected to as not proper examination.

The WITNESS. It was previous to 1890. As to how long previous to 1890, I don't know. I know it was deepened prior to 1890.

Q. By whom?

2317 This is all objected to as not proper cross-examination.

The WITNESS. I think the United States Government did some deepening up there. Being asked if I know, I will say no, I don't know.

Q. You don't know when the deepening was done?

A. I give the bottom here in 1890.

Q. Do you know when that deepening was done?

Objected to.

The WITNESS. No.

As to how much of it if any was done before 1892, I don't know. Being asked how I can form any basis for assuming the high water would have been at the line which I have shown above what it actually was based upon the deepening of the river, unless I know it was deepened, I will say the fact that it was deepened is the material fact.

2318 As to whether it would be material to know how much it was deepened, in order to know how much additional elevation to give the assumed line, I will say it is shown here on the profile. Being asked if it isn't only shown that the bottom was at a certain place in 1890, I will say, yes. As to whether there is anything on the profile that shows the original bottom, I will say, yes, that dotted line. As to where I got that dotted line, I got that from the office. Being asked to refer to any data on which I based that dotted line, I put there, I will say it is put on as a dotted line because it is not a definite data. I said I got it from data in the office. As to what data, I will say Mr. Cooley would be good enough data for me. He was in the office. He gave it and told me his reasons for that. Being asked the reason for putting that

2319 on, I will say that would be sufficient reason. It is made dotted under the direction of Lyman E. Cooley.

Being asked whether the assumed elevation of the high water line would depend upon the correctness of what Mr. Cooley told me as to where the original bottom was, I will say, yes. As to whether it is based on any data I can produce in evidence in this case, aside from the statement of Professor Cooley to me, I will say, no.

Being asked whether the correctness of the elevation of the assumed high water line depends upon whether I was right as to where that original bottom was, I will say, yes. Being asked if the original cross-section of the river at that time was higher than it is now at that point, then my as-
2320 sumed height of the water would be incorrect, I will say, I don't know.

Q. You have stated that the high water did not follow the assumed high water, the actual high water was as observed, because the bottom of the river had been changed, and had been deepened. If the bottom line of the river in 1892, was the same as it was prior to that time, then your high water line would have fallen to the level of the observed high
2321 water of 1892, would it not?

Objected to, as not proper cross-examination and further on the ground that the questions assume a condition which the evidence in this case shows conclusively, is impossible.

The WITNESS. I will say, I don't know.

Being asked if I got the water up to that line because I said that the bottom had been excavated, I will say, yes.

Q. If you have placed the high water line at the elevation that you have on the theory that the bottom had not been excavated, and that should prove to be untrue, then you have the high water line at too great an elevation, haven't you?

Objected to, on the ground that the question contains a hypothesis which there is not evidence in the case to warrant.

2322 The WITNESS. If you have proved that the ground was wrong it would depend; if the ground was higher there the high water would be high. If it was lower, it would be lower. It depends on the correctness of my assumption as to that bottom line. As to whether assuming a cross-section in the Chicago river in 1892, not greater than it was in a state of nature, this probable or assumed flood line would then be reduced to the actual observed line, I will say, no. If you brought it clear down to the observed line of 1890, of course,

it would be the same; that is not the line that is being
2323 treated. Assuming that the cross section is the same, that is axiomatic. Being asked under that condition how much water you would have on the east side of the divide, I will say, I don't know. As to whether you would have any or not, I will say it is shown here.

Being asked could I figure the amount of water that there would be upon the east side of the divide, assuming that the cross section of the river remained the same in 1892, that it was in the state of nature, I will say no.

Q. Why not?

That is objected to; all this line of questions are objected to on the ground that the questions are not specific.

The WITNESS. I cannot answer that.

2324 Being asked if I have given the depth on the assumption of a changed condition there, I will say, yes. Being asked if I figured them at any point, the probable flood line shows for itself as probable, I did not figure it at any point. That which was absolute is put on in full lines, and that which is probable and of which I have not the exact figures for was put on in dotted lines; that shows for itself. Being asked if I figured it on some basis, to get the depth of the water on that assumed line, I will say, no, I did not. Being asked, if there is any reason why I should not put it four feet higher than it is, I will say there are plenty of reasons. The projection of that flood line is the natural projection of the high water line of 1892, where the land breaks. Being
2325 asked if I cannot speak of a thing as a natural projection without being able to show as an engineer why it would continue at that elevation, I will say it shows for itself right there. Being asked whether my only answer as to why it is continued at that elevation is because it shows for itself on the map, I will say that is a good answer. I have no other to give.

Q. Do you know whether or not there would be as much as six inches of water on the east side of the divide if the cross-section of the river remained in 1892 the same as it was in a state of nature? I am speaking now of the probable flood line?

Objected to, as assuming a condition which the evidence in the case shows is absolutely contrary to the facts. It is further objected to, on the ground that the

place where the cross-section of the river is referred to, is not made specific.

The WITNESS. Sure.

2326 Being asked, what computation would produce that result, I will say I know that Mud Lake, and the whole region over there was overflowed, and that the water came towards Chicago in such quantities that it would have required more than six inches; I knew that as a fact. Being asked how I knew that as a fact, I will say from the quantity.

Being asked if I was there in 1896 I will say, yes, in
2327 the spring, I think, of 1896. I cannot give the month.

That time I went down near Kedzie avenue. Being asked if I observed the water at that point at that time, I will say, generally. As to whether I am prepared to say now that there were more than six inches of water at Kedzie avenue at that time, I will say, no; the high water marks did not go up to that point there, in 1896. As to what the width was of the cross-section at the divide in a state of nature, I will say I don't know. Being asked if I would be able to compute the height which the water would obtain without knowing the cross-section over which it spread, I will say, I don't know. Being asked if I know of my own knowledge that any change had been made in the depth of the river at that point in 1892, from what it was in a state of nature, I will say, no.

Q. Do you know what encroachments had been made on the original river in 1892?

2328 Objected to, as not proper cross-examination.

The WITNESS. I have made no survey for this myself, no.

Q. In order to arrive at the probable elevation in a state of nature as related to actual elevation as observed, in order to arrive at any conclusion of any value, would it not be necessary to study the question of encroachments on the river?

Objected to, on the ground that it is not proper cross-examination.

The WITNESS. It would not be necessary for me to know, because I am drawing at the direction of another man, and consulting records as I find them. As to whether I have consulted any records to ascertain what, if any, encroachments there were upon the river below that point, I will say, no, I have not taken into account in my computations the matter of any encroachments upon the river below that point. Being asked if I have assumed for the purpose of that line that there

were no such encroachments, I will say I have not assumed anything. As to whether it is not a fact that in drawing
2329 that line I simply followed the directions of Professor Cooley, I will say, sure; that is the top line and in putting in the assumed bottom, I have done the same thing.

COUNSEL FOR DEFENDANT. I object to the introduction of the profile on the ground that it is based upon data of which all is not produced, or introduced in evidence in this case; on the further ground that the witness who made the profile and testifies to it, has testified that as to important particulars it is not based upon knowledge possessed by him. I further object to it as incompetent, immaterial and irrelevant.

Re-direct Examination by Mr. Cressy.

Referring to the lines on this map that are dotted, I have testified that those are assumed lines. Referring to the lines that are not dotted, but are drawn solid, they are not assumed lines. Take the line which is shown beginning at the extreme right hand of the profile at a point which is slightly below minus 2, and which extend in an oblique direction into the yellow marked "A little canal," that is the hypothet-
2330 ical bottom as it existed in a state of nature.

COUNSEL FOR GOVERNMENT. If you will take this profile and mark upon that line "Assumed" as you have just answered the question.

The WITNESS (writing on profile): Assume line in a state of nature. I have testified that my authority for making that line as I have drawn it, was Mr. Lyman E. Cooley.

Referring to the dotted line beginning at the extreme right of the profile at a point marked 11.6, and extending in an oblique direction to a point marked 13.72, and extending to the left to a point marked 14.3, and then across the map corresponding very closely to a solid line, that is the hypothetical high water. As to what bottom that hypothetical high water refers to, I will say to the dotted bottom made about the same line as the top. In other words, the hypothetical line of high water, represents the flood condi-
2331 tions as they would have existed, if the bottom had remained in a state of nature and if they had remained as assumed by my hypothetical bottom line, in a state of nature. The actual elevations that were measured for the flood of 1892, from Kedzie avenue to Hoyne avenue, are shown upon this map.

Those points are 9.3 at Kedzie avenue; 9.36 at Bridewell; 8.4 at the railroad; and 8.09 to the extreme right of the profile at Hoyne avenue; and the bottom at the time those actual measurements of the flood were made is represented by the words, "bottom in 1890."

COUNSEL FOR GOVERNMENT. We offer this profile in evidence and ask that it be marked "Parry Exhibit 3."

(Said Parry Exhibit 3 appears in the Appendix, p. .....)

COUNSEL FOR DEFENDANT. I repeat the objection heretofore made, and the further objection that it does not contain and we have not been furnished with the remainder of the observations made of the high water line of 1892, at the points on the Chicago river below Hoyne avenue and Robey street; and that they are essential in order to determine the correctness and accuracy of the assumptions made on this profile.

COUNSEL FOR GOVERNMENT. In answer to counsel for defendant I will state that we are prepared to give him
2332 the elevation on the Bridgeport gauge and the elevation on the Lake street gauge, which were the only two gauges which were read in the river for the flood of 1892. (Handing document to counsel.) I can have that certified for you, if you would like.

COUNSEL FOR DEFENDANT. I would like also a certificate that there were no other readings upon the river at that time.

COUNSEL FOR GOVERNMENT. Well, there were several readings that day, but that shows the height of the flood, the extreme height.

COUNSEL FOR DEFENDANT. I want all of the readings that were taken that day on all of the gauges.

COUNSEL FOR GOVERNMENT. We will endeavor to secure a certificate of that sort. Not knowing whether there were any other gauges or not, it will be impossible for me to answer the objectiou until I have investigated.

2333 LYMAN E. COOLEY further testified as follows:

Re-direct Examination.

Mr. Parry testified that he placed the assumed bottom line in a state of nature as shown on this profile pursuant to directions from me. As to what my authority is for drawing a line for the assumed bottom line in a state of nature, which was shown on this map as extending from a point below —2

at the right hand of the profile to the yellow portion on the profile marked "A little canal," I will say the divide east of Kedzie avenue is taken at elevation 10.5, and the bottom of the little canal referred to by Phillips and Graham and Long, is taken at elevation 9.75 or lower. That fixes the end of the hypothetical bottom at the divide. The other end is fixed at a point between Robey street and Western avenue as the
2334 head of navigation on the west fork by taking the seven mile portage road from the Desplaines river as terminating at that particular point, which it would do, and assuming that there was boating depth up to that point. If the boating depth had terminated at a point east of that, the road would have gone to that point. If it terminated at a point west of there it would have gone to that point, but it happens to go on a length of seven miles to the point indicated as two feet below Chicago datum. The straight line is then drawn between the two points indicated on the divide and in the west fork joining these two points as the probable bottom, which may have been straight or may have been curved. That is the basis of that hypothetical line.

Referring to the dotted line beginning at 11.6 at the extreme right of the profile and extending to 13.72, and then toward the left across the profile which Mr. Parry has testified is the probable flood line on this hypothetical bottom, my authority for the figures 13.2 and 11.6 is, taking that part of the profile from the divide west, there are two considerations which have determined my mind upon that subject. The first of these considerations is based on the cross-section and the width of the profile at the range line, and the depth of overflow and in comparison with the width of overflow at the Kedzie avenue divide, the width of overflow at the
2335 Kedzie avenue divide being substantially double that at the range line. By comparison of these two points you get the elevation approximately as given, 13.72. The other consideration comes from the profile itself, which deports from the Desplaines river going well toward the Kedzie avenue divide without any apparent lowering or change due to the Ogden ditch in the western portion of portage swamp. By taking this profile over this portion where it appears to be substantially unchanged by the altered conditions and prolonging it to the crest of the divide, we reach substantially the same point as in the other consideration, the same elevation, 13.72. If there is any error in this assumption it would be in the direction of too low an elevation, due to the fact

that we have ignored the lowering effect of the Ogden ditch in the western part of portage swamp. These are the two considerations upon which I have drawn the hypothetical line.

Being asked my authority for the point 11.6 at Hoyne avenue, I will say that is a conservative assumption that the water in the original condition of the Chicago river that passing in 1892 would have passed that point at an elevation of 3½ feet high, and is based not on precise calculations or knowl-
2336 edge of the conditions, but seems to be in train with the conditions that we have brought to the Chicago Divide.

Q. To what years would the hypothetical flood line in a state of nature refer, Mr. Cooley?

Objected to, because no foundation laid in the evidence for the conclusion of the witness in answer to the question.

A. It would refer to a condition of nature which was first changed in some slight degree by the opening of the Chicago river in 1834 at the mouth and was radically changed after the cutting of the Chicago Divide in 1852 during the growth of the city and the development of the Chicago river as a harbor.

Re-cross Examination.

Being asked how I get the depth of —2 feet in the Chicago river at Robey street in a state of nature, I will say I have explained that already, that that depth is assumed as a depth which would be required, or a depth in that vicinity, a foot and a half to two feet or more, for boats at the head of
2337 navigation or at the landing point for the seven mile portion.

Q. If it happened to be four feet or six feet, your assumed bottom would be two feet or four feet lower, wouldn't it?

A. If it happened to be four or six feet, probably the depth at which the portage road would take off would have been further along, at a point about two feet.

COUNSEL FOR DEFENDANT. Move to strike out answer as not responsive to the question and as an argument of the witness.

(Question read.)

The WITNESS. That is an automatic question.

Q. But it automatically answers itself in the affirmative.

A. Sure. A man could do that with a phonograph.

As to what effect that would have upon the assumed high

water flood line of 1892, I will say I do not know that it would have any.

Being asked whether I would draw that line at the same elevation if my assumed bottom line terminated at Hoyne avenue, four feet lower than I have terminated it, I will say I have not drawn any assumed bottom line beyond the point at which I terminated the portage road.

2338 The line represents the portage road. As I put it on the map I directed it to be extended from the end of the portage road to the divide. I do not know what depth was at Hoyne avenue originally.

As to whether if it were four feet instead of two feet and a fraction at a point 1000 feet west of Hoyne avenue, I would still carry the high water line of 1892 at 11.76, I will say I did not consider the bottom at that point, so I do not know whether that hypothetical line would correspond to a depth of two feet or four feet, or to what depth it would correspond at Hoyne avenue.

Being asked if I have brought my assumed bottom line at Hoyne avenue to a point one and a fraction below minus, and assuming that that bottom was six and a fraction, as to whether the high water line of 1892 at Hoyne avenue would remain at 11.66, I will say I could not tell from that consideration alone. If that was the ruling factor in determining the elevation at Hoyne avenue, then deeper water would lower the line; if it was not the ruling factor then it would not change it.

2339 As to how I know it is not the ruling factor, I would say the elevation at Hoyne avenue is determined by the conditions east of that point and not the conditions west of it. That would be true at any period, unless you had a waterfall or cataract immediately above determining matters west.

As to whether an increase in the depth at Hoyne avenue to six feet would not effect the assumed high water line as projected upon this profile, I will say it would depend all together upon what resistance there was between there and the lake. No conditions coming to Hoyne avenue from the west would effect that elevation except the water supply itself.

As to whether the elevation of the ground over which it flowed would have any effect, I will say not to the west of it, except as it might produce rapids or waterfall immediately west. Of course, that might produce a steeper slope

2340 west of that point. If it did procure a steeper slope it would raise the assumed water line a little higher over

the Chicago divide. As to what effect it would have at Hoyne avenue, I would say it would not affect that. It depends on the resistance to the east, down the stream.

Being asked whether there was no greater slope to the east of Kedzie avenue than to the west of the range line at the time of the flood of 1892, I will say it is not clear
2341 to my mind as to what slope you refer to west of the range line. The slope on the twelve-mile level at Summit is about three feet in a distance of twelve or thirteen miles. The slope to the east of Kedzie avenue, as they exist now, is something over a foot in a mile and a half. Taking the same places in a state of nature in a flood such as there was in 1892, the slope west of the range line in the twelve-mile level has not materially changed. The slope in a state of nature between Kedzie avenue and Hoyne avenue under the same conditions was very materially changed. As to what was the slope before the change, in the mile and a half from Kedzie avenue to Hoyne avenue, I will say I allowed between the divide and Hoyne avenue, a distance of about a mile and a half, 2.12 feet on the hypothetical line. That is what
2342 I have taken for the slope in a state of nature. As to how I arrived at that, I have already stated on my direct examination in answer to Mr. Cressy this afternoon and on a former occasion when I was interrogated at length both on direct and cross-examination. It is not based upon any particular depth of the Chicago river. It is based on a general condition that existed prior to the improvement of the Chicago river in comparison with the present condition, or the condition that existed in 1892. As to whether that, among other things, involved an assumption as to the depth
2343 existing in a state of nature in the Chicago river, I will say I do not think that I made an assumption there any further than that the depth had been greatly increased by the improvement of the stream, and made uniform, and in places had been widened. Assume that the cross-section in the Chicago river were no greater in 1892 than in a state of nature, as to where the flood line would be in a state of nature relative to the flood line as actually observed in 1892 at the bridewell in the Chicago river, I would say it would be no
2344 greater or less. I presume if they were identical they would give identical results under identical conditions. Assume the probable flood line east of Kedzie avenue to be as shown on the blueprint introduced in connection with Mr.

Parry's evidence this afternoon, and assume the elevation at the bridewell in the Chicago river to be as actually observed in 1892, how deep the water would be on the east side of the divide, I will say I do not believe I can guess that. The question is not understandable to me. The elements that are not sufficiently certain to enable me to answer are, it is impossible for me to conceive that the water rose from an elevation of 9 feet and a fraction to an elevation of 11.6 at Hoyne
2345 avenue, a distance of a mile and a half, which your question postulates. The question as I tried to comprehend it referred to a hypothetical observation at Hoyne avenue.

Q. It did not. Read the question to the witness again:

(Question read as follows: "Assume the probable flood line east of Kedzie avenue to be as shown on the blueprint introduced in connection with Mr. Parry's evidence this afternoon, and assume the elevation at the bridewell in the Chicago river to be as actually observed in 1892, how deep would the water be on the east side of the divide?")

COUNSEL FOR GOVERNMENT. The question is further objected to, on the ground it asks the witness to answer the hypothetical question which assumes the water to have been actually as it was in 1892, at a point where we have the actual measurements upon the assumption, if I correctly understand the question. Otherwise I object to the question as unintelligible.

Q. Now, Mr. Cooley, let us make it more clear. Your trouble with the question is that the assumed flood line is at 11.6. The question assumed the probable flood line at
2346 Kedzie avenue. There you have it at 13.72, and that the elevation of the bridewell in the Chicago river is as actually observed in 1892; then how deep would the water be on the east side of the divide.

Same objection.

A. I am unable to answer the question with the data contained in the hypothetical question. I have the volume of water, the slopes and distance. I have not the cross-
2347 sections here so I can make no comparison in that matter. I do not remember what they were. I said the cross-section was about double that at the range line and that was on the divide itself and not in the ditch. I am unable to state as to whether or not there would be as much as three inches on the divide under those conditions on the east side of the divide.

As to what is the earliest survey showing depths in the Chi-

cago river and in the vicinity of Hoyne avenue, I will say I do not know.

2348 Q. Have you made any investigation to ascertain what the early surveys show as to the depths there?

Objected to, on the ground that this matter has already been gone over on the cross-examination.

A. I have not in connection with this matter now before us. At one time I was familiar with everything that existed upon the subject, but that was twenty years ago.

As to whether at the time of making this profile I was not familiar with these facts, I will say I remember their general significance.

As to what the earliest survey I can recall contains as 2349 to the depth at that point, I will say it is stated in some of the old reports that the depth of twelve feet went up the Chicago river for two or three miles from the lake, and we have further statements respecting the Chicago river and its characteristics, width and other qualities, from the statements by Long and Phillips and Graham, and from the land surveys before man had made any changes except the opening of the mouth of the Chicago river.

COUNSEL FOR DEFENDANT. Move to strike out the answer as not responsive to the question.

COUNSEL FOR GOVERNMENT. Have you completed your answer?

2350 The WITNESS. No, I have not. These surveys and reports, so far as I recall them, indicated a river at much less depth and much less width than has existed since the improvement of the stream. Furthermore I was instrumental in having a survey made of the Chicago river while connected with the Sanitary District, in which we attempted to reproduce some of the conditions existing during the early surveys. It is from my general knowledge of those conditions that I formed an opinion, and as I have stated, in view of the fact that I have not refreshed my memory upon these matters, I took the elevation at Hoyne avenue at what I thought to be extremely conservative, so as to be within safe limits.

COUNSEL FOR DEFENDANT. I now enter my protest against the evident desire of the witness to avoid answering the question, and, under the guise to an answer, to insert matters which apparently he deems valuable to the government's case; and conclusions upon data not referred to in the question or referred to in the answer, and I again move to strike out the answer as not responsive to the question.

2351 Being asked again what is the earliest survey that I now have in mind, showing the depth of the Chicago river, I will say I cannot tell you without refreshing my memory.

Being asked what significance the words "levelled by so and so, engineers," upon a profile would have, I would say it would indicate the authority, I presume, for the levels. It would indicate that the men named were the men who did the leveling. I have testified that my judgment was that the profile of 1867 was based on Preston's profile of 1858. I have not the profile here.

2352 Being asked whether I know H. G. Paulfrey and H. E. Worrall, and that they were assistants of Mr. Wilson in the 1867 survey, I will say they were in the second survey. I have never seen a profile of the survey in 1867. As to whether I have seen a profile that is usually referred to as the profile of 1867, and which was referred to in the state case as the profile of 1867, I will say that was the profile which accompanied the first report of General James H. Wilson. Whether that profile contained this language, "Levelled by H. G. Paulfrey and H. E. Worrall, Civil Engrs. Assts." that I don't know. A profile containing such words would indicate that it was made by Mr. Worrall and Mr. Paulfrey, but Mr. Worrall was employed on the later surveys, which were subsequent to the profile which was submitted by Col. Wilson in connection with the first report.

2353 Q. You have already stated that there was but one profile in connection with the 1867 survey, and you have stated that that was the Preston profile. If it appears upon its face to be levelled by H. G. Paulfrey and H. E. Worrall, and they were not connected with the Preston survey but were the assistant engineers in the 1867 survey, are you not mistaken in your assumption?

A. I will say that I think you are confusing two matters there in your question, Mr. Scott. There was no profile published in connection with the report printed in 1868, which was the survey actually made in 1867.

There was a profile printed in connection with Mr. Wilson's report submitted early in 1867, but that profile was prior to the employment of Mr. Worrall and Mr. Paulfrey, who were employed in connection with the latter survey, and later report. My reference was to the report published by General Wilson which I have seen, but do not recall having seen the other. I have seen the profile that is attached to the re-

port of 1867. As to whether that profile upon its face is stated to have been levelled by the two men named, I
2354 will say I do not recall that. I do not think that these men were connected with the Preston survey. I am very clear that the government made no profile of the Illinois river prior to General Wilson's first report. As to whether, assuming that that profile is described on its face as having been levelled by these two men, if I would consider that I was mistaken in ascribing it to the Preston survey, I would not want to say that without further investigation. Assum-
2355 ing the facts as stated, it would puzzle me greatly to find that those two names are there.

Q. You say that General Wilson refers to a condition in which the flow of the river is reduced to about 1000 feet per minute, or between 16 and 17 feet per second, and you say that he refers there to a condition existing which was after the deflection in the lower Desplaines river below those dams that I have mentioned. What year was he referring to?

A. The quotation was cited by you from the report printed in 1868 and referred to the year 1867, I presume, and the conditions existing in that year.

As to whether it is true that the conditions existing in that year, instead of being conditions of depletion were in the net conditions of addition to the Desplaines river, I will say I think not.

Being asked whether the Bridgeport pumps discharging into that river were discharging into that river during that year, I will say I presume that they operated that year
2356 for a very large part of the year because it was the year of the least rainfall experienced in this country for 68 years, the rainfall being only 22.4 inches.

COUNSEL FOR DEFENDANT. I move to strike out the statement as not responsive, as to being the least rainfall for 68 years.

As to whether as a matter of fact these pumps were operated 150 days during the year 1867, I will say I would not be surprised. As to who furnished Mr. Rauch the material contained in his portion of the work, "Water Supplies of Illinois," as to the operations of the pumps, I will say I do not know. I do not know the amount of water raised by those pumps at that time. I do not know what the expense of operating those pumps was. I do not know whether they contributed at that time 10,000 cubic feet per minute.

As to whether I have any knowledge as to how these
2357 pumps contributed to the Summit level up to the time they were enlarged in 1860, I will say, I do not know; nor do I know about their enlargement.

As to whether I took any pains to ascertain in determining the depletion of the river what additions were made to it by artificial means, I will say I have always assumed in regard to that early period that the pumps were operated legitimately for the purpose of feeding the canal. That was the purpose for which they were erected.

Q. They fed the canal many times more than the low water volume of the river didn't they?

A. There have been some statements made which I think I have referred to myself, that in the winter season when the navigation was suspended the City of Chicago did contribute to the operation of the pumps in order to maintain the flow in the Chicago river; but in the year 1867 I think it is a fair presumption that they were not operated for any other purpose than feeding the canal, in view of General Wilson's statement that the river only contained 77 feet per second at the mouth.

As to what would be the amount necessary to operate
2358 the canal, I will say that I am unable to say at that early stage of its history when the banks may have required a good deal of water for seepage, I should say it was somewhere between six and twelve thousand feet per minute. That is just a mere assumption on my part in regard to the six to twelve thousand feet. I think it would be at least that.

Being asked whether as a matter of fact with those two wheels in operation as it was reconstructed in 1859 and 1860, 25,000 cubic feet of water were easily lifted into the canal, I will say I do not recall without refreshing my memory what the capacity of those pumps was. Ossian Guthrie is the best authority on that proposition.

As to whether I looked up anything that he had written on the subject, I will say I was familiar with his views about
twenty years ago on the subject when the matter was
2359 up for the Chicago river. If he said "With the two wheels described 25,000 cubic feet of water per minute was easily lifted over a head varying from five to ten feet," I regard it as true as to the capacity of the pumps.

(Whereupon counsel for the defendant reproduced the profile heretofore referred to and read its title as follows):

"Profile of the Illinois River and Illinois and Michigan Canal made under the direction of Brevet Major General J. H. Wilson, Lieutenant Colonel U. S. A., 1867. Levelled by H. G. Paulfrey and H. E. Worrall, Civil Engineers Assistants. Drawn by G. E. Keefer." As to whether I am still puzzled or not, I would say, I must defer to answer until I have a chance to examine it. I want to know before I complete my answer on the matter, as to whether the profile shows that this was to accompany the report of 1867, or the one that was printed in 1868.

COUNSEL FOR DEFENDANT. It states nothing on it in reference to accompanying any report. It says, 1867, that is all; made under the direction of Brev. Maj. Gen. J. H. Wilson, Lieut. Col. U. S. A., 1867. I don't think there can be any question but that that is the profile that we have always referred to as the profile of 1867. It appears there as an exhibit in the State case.

Whereupon counsel for the government stated that that was another profile; it was the one that was attached to the report of 1867 and that this profile omits the statement in reference to the Illinois and Michigan Canal, which appears on the profile in the book.

Q. We have now made a search here of the exhibits and we have been unable to find any other profile of 1867 other than the one referred to in my question. Are you still puzzled?

2361 The WITNESS. I shall continue to be puzzled, Mr. Scott, until I examine the original report and the accompanying profile of General Wilson. It would seem as if a profile had been produced, not the survey reported late in 1868, which I identified with the other profile. It may be an independent profile. I would want to examine that a little more carefully to be sure about it. You may be right about it, but before stating so positively I want to be frank about the matter. If I have made an error, I want to confess it at once.

2362 The canal from Joliet to La Salle was supplied by the Desplaines river in part. It was only in part. The water that was brought down then, being water from the Summit level, was discharged into the river. The canal and river commingle in the two basins at Joliet. That would result in a discharge into the river.

The Channahon level begins at the end of the second basin

at Jefferson street, Joliet. It had originally a feeder from the DuPage river above Channahon, on the Channahon level. The feeder came into the canal above Channahon itself. Then it crossed the DuPage river in a pool at Channahon about four miles above the mouth of the Desplaines river, and tapped the DuPage river at some distance above Chan-
2363 nahon where a dam was constructed across the DuPage river to supply this feeder. It may have been a couple of miles up the DuPage river. I wouldn't know that exactly. from the Channahon crossing. I do not know how much water is supplied to the canal. Some portion at least of the water in the Channahon level was supplied by the DuPage river in that way. It was in the early days. I do not know when that feeder was abandoned. Subsequently there was no supply to the Channahon level except the Joliet supply and the DuPage river supply so far as I remember. The Kankakee feeder is on the Dresden level. I think there never was any feeder for the Channahon level. I say that Major Wilson, speaking in the year 1867, must have had in mind the conditions existing after the depletion in the lower Desplaines river below those dams that I have mentioned. I have assumed that the amount of water contributed to
2364 the Summit level and discharged into the Desplaines at Joliet, was identical to the amount used in the Channahon and lower levels for the operation of the canal. The quotation from General Wilson is confirmatory of that idea. Further than the assumption that the canal pumping works and feeders would be operated for legitimate purposes, I have inferred that they had no other purpose in view than to supply the canal.

The sewage question did enter into it in the winter time, as I have stated. I am not advised as to whether it did in the summer time. As a matter of fact they did pump water not only to supply the canal but for the dilution of the Chicago sewage, in the winter time. As to whether or not General Wilson referred to the condition of the Desplaines river after the depletion of the lower Desplaines river below the dams I have mentioned, would depend upon in some degree, whether or not the amount contributed by the pumps equalled or exceeded the amount of the depletion through the cause that I have mentioned. I would say that I have assumed differently; that there was no more water than was required in view of the very meagre amount for the flow in the river below.

As to whether that meagre amount which remained flowing in the river below was precisely the amount that Bucklin in the report of 1843, found as at times flowing in the river, 1,000 cubic feet per minute, I would say that I do not know. As to whether there was any depletion prior to 1833, I would say that I do not know of any other. I do not remember who Bucklin was. As to whether I remember that he was the first engineer employed to lay out the canal, I would say there 2366 were surveys in 1833. The lands for the canal were granted in 1827. As to whether Bucklin was the first engineer employed after the grant of lands for the canal, I would not say. As to whether I remember that in Bucklin's report he stated that the river Desplaines in the fall of 1870 the discharge at that period was reduced to 60,000 feet per hour, will say I do not recall Bucklin's report at all, if I ever read it.

Q. That is precisely the amount Wilson refers to in 1867?

A. 60,000 feet an hour would be 1,000 feet per minute. I do not remember that Bucklin reported that the "minimum discharge of the river Desplaines is only 60,000 cubic feet per hour. Of course it is not competent to supply even the lockage, which on this plan cannot be less than that required for the canal) without taking into consideration the loss by evaporation and leakage, which would alone consume at least seven times the quantity of water discharged by the river Desplaines at its lowest stage." What point does he refer to? He is probably referring to the river as used for a canal above Joliet somewhere. I do not remember that in the report of Mr. Bucklin he stated:

> "The river Desplaines was gauged, at Laughton's Ford, by Messrs. Post and Paul, in the first survey that was ever made of the route of the Illinois and Michigan canal, and the discharge found to be 72,000 cubic feet per hour."

Q. A little more than Wilson referred to in his report of 1867?

A. About 1,200 feet per minute. As to the reason why I think Wilson referred to the condition before depletion I said:

> "This volume mentioned by Gen. Wilson would be utterly inadequate to produce any water power at Joliet in connection with the dams that are alleged to have existed at that point, in fact most of it is from the water shed below Joliet."

As to whether in a later report it says, "On the 8th of August, 1830, Messrs. Harrison and Guion, on the 8th of August found the discharge 60,000 cubic feet per hour," I would say that would be considerably increased at the mouth of the river.

As to whether in connection with my statement that that volume would not be adequate to produce any water power at Joliet, I recall in the report of Benjamin Wright,
2368 October 23, 1837, "The past dry season rendered the measuring of the Desplaines almost unnecessary, since for nearly four months the tightest dam that could be erected would not, at the point for taking out the feeder, have saved water enough to propel a single pair of ordinary mill stones," I would say I do not know who Mr. Wright was. He was an engineer brought on here from the Erie canal, as I recall. I think he made a report recommending the slack water of the stream to be fed, I think from Lake Michigan. I do not recall that distinctly.

Q. It would then appear that he stated concerning the dry season of 1830, the same fact as existing, namely,
2369 the inefficiency of water to run a single pair of ordinary mill stones, which you reply on as one of the reasons why General Wilson must have meant some other condition than that of a state of nature, did he not?

A. My remark was made in regard to the water wheels and mill stone in view of the statement by counsel in regard to the excess of water being taken across the Chicago divide, for the purpose of feeding mills, and it occurred to me that there was not any excess of that character to feed any mills. I am unable to state as to whether the records show that there was not in early times any excess to feed such a mill.

Q. Did you in connection with the state case become familiar with the case of *Druley* v. *Adams,* as to which the records were offered in evidence?

Objected to as not cross-examination.

A. I remember that there is such a case, but I don't remember it in connection with the state case particularly.

Q. You remember that there speaking of the mills below Joliet they were referred to as thunder shower mills?

Same objection.

A. That I do not. If, as a matter of fact, there were mills prior to the depletion to which I refer, which could only be operated at certain stages of the water and for consid-

erable periods could not be operated, as to whether any deduction I may have drawn as to Wilson's report, such
2370 as I have read referring to the operation of mills, would be unjustified, I would say that deduction was not made by me; it referred to a deduction made by you.

COUNSEL FOR DEFENDANT. I made no such deduction.

In dry weather and in certain years just prior to 1889, when the water supplies of Illinois was published, I think it is true that in extreme low water after the pumps were erected, over half the low water volume in high water years, between Joliet and down as far as Peoria, came from Lake Michigan. The pumps were formally put in operation and delivered to the city late in 1886. The wheels were operating whenever there was a deficiency in the supply to the Summit level from the beginning of the canal. I am unable to
2371 state what portion of the years they were operated. If it appears in Mr. Rauch's report that in 1866 they were operated for 62 days; in 1867, 150 days; in 1868, 73 days, and in 1869, 100 days, I presume Dr. Rauch had good authority for making such statements.

Referring to the passage from this same report:

> "From the year 1860 to 1865 the pumps at Bridgeport were only used to supply to the canal such water as was needed for navigation, and their action in purifying the river, though marked and valuable, was only incidental. But in the latter year the Board of Public Works made an arrangement with the Canal Commissioners to utilize the pumping works as much as possible for the cleansing of the river. It happened, however, in that year that unusual rains kept the river in fairly good condition
> 2372 without this extra use of the pumps. But the arrangement was maintained, and in 1866 the pumping works were in operation for 62 days; in 1867 they were operated 150 days; in 1868, 73 days; and in 1869, 100 days."

As to whether having refreshed my memory by that reference to the water supplies of Illinois, it is not true that after 1865 the pumps were not only used to supply the water needed for navigation, but also for sanitary purposes for the benefit of the City of Chicago, I would say I have already called attention to their use in the winter time, gathering that information from early city reports. I do not know whether Dr. Rauch refers to a winter use or to a summer use.

Inasmuch as he is referring both to supply the water necessary for the canal and also for purifying the river, I think it

would be assumed that he was talking about the winter months. No water was supplied to the canal in the winter for navigation. Therefore, I assume that it was during that time when the Chicago river was not purified by the circulation due to the pumps, that the pumps were operated, and I so stated in former testimony. If they had been operated to supply the river, Mr. Scott, there would have been more water than General Wilson claimed to have in 1867.

2373 COUNSEL FOR DEFENDANT. I move to strike out the answer as not being responsive to the question.

There was a chemical investigation of the water supplies of Illinois by Professor J. H. Long, an appendix to that same book.

COUNSEL FOR GOVERNMENT. I object to this as not proper cross-examination, and any question pertaining to this line of examination.

I have not looked over the chemical investigation report since the report was written. I was famiilar with it at that time, at the time Professor Long and myself were colaborers in that work.

Whereupon it was agreed that objection on the part of the government might stand as to all questions concerning this report without repeating them to each question.

2374 As I recall the samples they were taken from the Desplaines and Illinois rivers at intervals during one summer and one winter. He says "Over 650 of these tests were made between May 4th and November 15th, and about 100 between January 14th and March 15th,—these latter chiefly of waters of the Illinois river." I think the report was actually printed in January, 1889, and was written in the latter part of 1888. As to whether it was stated in that report that the Illinois river at Morris is practically made up of Kankakee river water and canal water, I would say that may be so. I do not know. If that were true it would be water that came down the canal and was discharged at Joliet and found its way through the river Desplaines and not through the Channahon level to the Illinois.

Referring to the act of February 28, 1839, entitled "An Act declaring the Desplaines river a navigable stream," I located the point on the Desplaines river as that where the Desplaines river most nearly connects itself with the Illi-

2375 nois and Michigan canal, as being at Summit. There are quite a number of points where it is contiguous to the canal, and in making that statement I was unhappy in

the language which I used. What I had in mind to say was, where the canal going out from Bridgeport first approached the Desplaines river, in the vicinity of Summit.

I notice the Act does not say where it first approaches, but where it most nearly approaches, but what I have said is my idea of what the Act means.

The canal most nearly approaches the Desplaines river a couple of miles below Summit and it runs adjacent to the river all the way to Willow Springs and again is adjacent at points between there and Sag. In fact, runs through the river at Sag, occupying a part of its bed. It again approaches it above Lemont and is contiguous to it, but after leaving Lemont it does not again approach it closely until it actually enters the river at Joliet.

2376 I have stated that a volume of 305 second feet at the Riverside gauge corresponding to an elevation of 13 feet on the gauge, there would be a volume at the mouth of the river of 686 second feet. That is on the assumption that the watershed yields equally well from Riverside to the mouth and is pro rata with the area drained. That is the way I figured it. I think that is sound assumption, in view of the large special effect exercised by the Portage Swamp region and the 12-mile level and the good yielder in the DuPage river basin.

I modified my conclusion in regard to the effect of the drainage of the Kankakee Marsh, in some degree. I formerly took the position, and think I did in that report, that the drainage of these marshes would endanger the water supply to the Illinois river and result in a much longer continued low water period. I have modified that view somewhat. As to whether that modification was due to the fact that the event was wrong, I would say, it was not. I do not know what the event is if there be any.

2377 As to whether up to the present time there is any indication as to any such result as I prophesied, that I do not know. I am not specifically informed in regard to any flow of the Kankakee river since the statements made by Mr. E. S. Waters. I have not made any effort to check up or verify the prophesies I then made. I have simply reasoned on the further light that I had in regard to the depth of sand and permeable ground underlying the marsh, and that the deep drainage of these sands and permeable ground might through ground water compensate in part for the effects of destroying the swamp. Whether they compensate wholly for

that or not I am quite doubtful; but my mind is not quite clear about that. I think it will take human experience to test that.

After colloquy between counsel, the word "prophesy" was withdrawn from the original question.

As to what further effect evaporation would have upon the volume of water discharged at the Riverside gauge on
2378 its way down the river, I would say, evaporation exists always and everywhere, and contributes to diminish the amount of water that flows in a stream. In my appendix I stated:

> "In 1879, a discharge was taken by Mr. Matthewson at Romeo, four miles above Lockport, gave a volume of 5.65 cubic feet per second; 339 feet per minute. The minimum volume at Riverside would not be increased, in fact might be diminished, in passing through the 12 mile level, by evaporation and vegetation, in the run to Joliet."

I think I also stated that "300 feet per minute may
2379 be assumed at the mean extreme low water at Riverside and at Joliet, with a volume below 1,000 feet for several months of nearly every year." Being asked whether the general body of the great swamps in Indiana is substantially unchanged according to the best of my information, and as to whether I have any information on that point, I will say I have not anything except hearsay, except as I have been across it on a railroad train occasionally and observed in a manner.

As to whether I know that vast tracts of land which 20 years ago were used as hunting clubs in those marshes, have been drained and are now farm lands, I would say that I know that considerable tracts have been drained in the watershed, and one tract especially on the borders of the watershed; but my information is that the great body of the marsh is still substantially untouched. My last information as to conditions existing there was in the last 90 days. The nature of that information was: A gentleman in my office had some topographical maps and wanted to ascertain something
2380 in regard to elevations in the Kankakee basin. In fact, there have been two gentlemen, I think.

The maps that I referred to were the ordinary one inch topographical maps of the United States, which reach over now, I think, into the Kankakee basin, but were not maps of the marsh as a whole. These maps have been issued in re-

gard to Illinois and Indiana for the last 15 years. I did not base my opinion on maps. I said a gentleman was in my office with some maps, topographical maps, asking about some elevations on the Kankakee watershed, and he had some statement that he made. This gentleman was asking me
2381 about the advisability of cutting a channel from the Kankakee marsh country for the purpose of draining the marshes by way of Deep river near Valparaiso, and about the elevation of the marshes in that direction.

Being asked if that is all he said, I will say I did not refer to it as being particularly in the way of information. I gathered from the conversation that there were some large bodies of land to be still drained there. I do not know what proportion they bear the original body of swamp lands.

Being asked if I know anything as to how the stream holds up its volume now as compared to what it did before there was drainage of the swamps, I will say, my information is that the volume is less now than formerly before there was drainage of the swamps. I got that from Mr. Kramer. I think he stated the present low water discharge of the Kankakee river, but I will not recall with certainty. He is the best authority on that.

As to what is the present low water discharge of the
2382 river: I do not know that I can recall Mr. Kramer's statement. I think it was in the vicinity of 300 feet per second. There was a measurement as low as that. It is lower than any that we have of record. I could not say what year he named.

As to whether it is not a fact that the low water discharge in recent years has been greater than it was in earlier years before the swamp drainage of the Kankakee river, I will say that I would not undertake to say. Mr. Kramer would be a better authority on that than I.

Referring to a statement made on my cross-examination as to a depth of 1 2/3 feet at LaSalle, and in reference to the effect of the canal water upon that depth, or rather, affecting the depth to that extent, I stated that this was based on a result given by Mr. Abert, in the report of General Wilson in the spring of 1867. I think that that statement was not from actual investigation and measurement.

As to whether it is true that that testimony was taken involving the question of how much had been contributed to the Illinois river, what volume of water had been contributed by the Illinois and Michigan canal, and that this statement is

based upon that testimony, I would say that I do not recall any particular measurements to determine that particu-
2383 lar stage of water, the volume passing at that particular stage of water. That was not part of the computation arrived at from testimony taken for the purpose of determining the effect of the canal upon the river, that I know of. I do not know that the matter was specifically referred to except in connection with Abert's determination of what would give 6 feet of water in the river. As to whether the statement made by Abert was not what it would give, but what effect the canal had upon the river will say I do not remember that Abert spoke of that further than to give an opinion as to what the capacity of the new deep cut would add to the low water flow of the Illinois river.

2384 Whereupon counsel for defendant moved to strike out each excerpt read from Chittenden's report, on the ground that it does not fairly appear that they represent the position of the writer from whom they were quoted.

COUNSEL FOR GOVERNMENT. In reply to the motion of counsel, I will say that counsel for the defendant is at liberty to introduce any other passages that may show a contrary interpretation or may explain the passages that were introduced in any way.

The WITNESS. As to whether I picked out and noted statement in the Chittenden papers, referred to by you as being by persons who disagreed with Chittenden, wherein they agreed with him on certain points, I will say that I marked all the significant passages that I thought had any bearing upon this case in the paper of Chittenden, the appendix thereto and the various discussions; and the attorney for the United States read such of those as he thought germane.

2385 As to whether he omitted excerpts from the same papers, which corroborated Colonel Chittenden, I will say that I think we have fairly stated the corroboration, that is the corroborating witnesses. Being asked if I attempted to show and if the excerpts read did show wherein they agreed with him, will say I think most of the excerpts agree with
2386 Chittenden, just as I do for the larger part. In certain instances I read excerpts in which the writers disagreed with Mr. Chittenden as to the effect of forestation upon the snow and the run-off from the snow. There were others among those whom I list as disagreeing with Chittenden, who agreed with him upon that point. I marked Professor Fletcher

and also Professor Snow. I also marked Le Baron on that subject.

2387 On page 33:

"This paper is very timely, and the author has handled the subject in a very thorough manner. His observation in regard to snow run-off from forest and open areas, are borne out by the writer's experience. In his early days, while running railroad lines in New England, in the early spring, he was often surprised to find the woods nearly devoid of snow, while deep drifts still remained under the road fences and stone walls, and in deep road cuts."

Whereupon counsel for the government offered to introduce the passage into evidence.

The WITNESS. I observed that when I read Le Baron's
2388 paper. I think I marked it to be introduced, but it was not introduced. I think that generally Le Baron disagreed with Chittenden. Upon the point just called to my attention, that is on the snow part of the proposition he agrees with Chittenden. Chittenden placed great store by the snow drift proposition, especially in the mountains.

As to whether I can point out a single line or sentence in which Mr. North disagrees with Chittenden, I would say, Mr. North goes into a discussion of conservation at considerable length, and expresses his conviction in favor of small forests free from taxation to be located on each man's farm. I should say that the whole atmosphere of that paper was against Chittenden.

As to whether I can refer to a single proposition controverted by it, I would say not specifically. Mr. North then says: "This very able paper brings up a collateral and important question: Even if they accomplish all that is claimed for them, will national forests be a national beneficence," and then goes on to discuss that collateral question and de-
2389 vote his paper to it. But Mr. North is discussing the political side of the question and does not enter into the merits of the paper itself. I happen to know the views of Mr. North from long personal association with him. He does discuss the political aspect of the conservation movement to which he is much opposed, and also the waterway question.

As to whether he controverts any proposition of Colonel Chittenden's, I would say that he does not go into specific

controversy. As to whether or not as a matter of fact he raises a single question on any proposition put forth by Colonel Chittenden, will say he does not discuss Colonel Chittenden's paper at all, hardly.

Mr. Childs says:

2390 "The author takes up the influences of forests upon stream flow, and states the commonly accepted opinion, that forests have a beneficial influence on stream flow. He then proceeds to controvert these opinions pretty thoroughly. Certainly, his arguments are strong and most interesting, and the writer frankly admits that he is entirely unable to meet them."

That was the position of Mr. Childs and as a matter of fact he did not undertake to controvert or argue those questions.

"Colonel Chittenden's arguments are so evidently based on careful study and years of practical experience that they carry great weight, and certainly one who has been able to give these matters comparatively little investigation should hesitate to combat them. The writer's interest in them, however, is intense, and, if they remain uncontroverted, they will be a strong argu-

2391 ment for politicians in Washington who are opposed to the Appalachian and White Mountain Forest Reserve bills. As a member of the Council of the American Civic Association, it was the writer's privilege, while in Washington, to use what little influence he had in the interests of these bills, the passage of which is believed to be of the utmost importance to New England and the South Atlantic States.

As stated, the above-noted opinions are very commonly accepted at the present time, and no one is more responsible for their common acceptance in the United States than Gifford Pinchot, Assoc. Am. Soc. C. E., of the Forestry Bureau, whom the author frequently quotes and whose writings and lectures upon this subject have been accepted by many, up to the present time, as the final word on the subject. The writer, therefore, is very glad to know that Mr. Pinchot is to be given an opportunity to reply."

As to whether Robert E. McNath disagrees with Mr.

2392 Chittenden, I would say, I think Mr. McNath's opinion is about the same as my own. I do not think that anybody disagrees with him on every point.

As to whether I say that a man disagrees without qualification, the assumption is that he disagrees with him in toto, I would reply that the papers are brought in here for the purpose of testing certain propositions in connection with the Desplaines river and I have had that in mind in referring to Mr. Chittenden.

Referring to the book entitled: "Improvement of non-tidal rivers," published by S. Janicki in 1881, he gives the total length from the Swiss frontier to the sea as 324.4 miles;
the total length from Lake Geneva to the sea would be
2393 337.4 miles, adding 13 miles in Switzerland. The first
33.7 miles of the river is unnavigable, I believe, except for rafts. The fall that I gave between Lake Geneva and the sea is 1230 feet. I do not know how much of that fall is in the first 33 miles.

As to how the fall is distributed generally throughout that river, I have stated I think we have quoted statements below the City of Lyons at the mouth of the Saone, what is called the middle Rhone.

What is between Lyons and the mouth of the Isere, I could not state without reference to the quotation which we have made.

The first stretch mentioned there is about 30 inches, I think. And the next 35½ and the next 50 inches. The main slope is 30 inches and the next 54 miles. And the next is a distance of 52.8 miles where the slope varies from 32 to 16 inches. It drops to only 4 inches between Soljean and Arles, a distance of about 3 miles.

2394 As to whether on the Maritime Rhone whose length is 27 miles, the low water slope varies from 1¼ to 2½ inches, according to the condition of the sea and the direction of the wind, I will say, that is within the tidal limits. The discharge of the Rhone at Isere is about 200,000 and some odd thousand feet at high water; at low water 8,123 cubic feet per second, and from the mouth of the Isere to the mouth of the Ardache, the low water discharge is about 11,830 cubic feet. The character of the bed in the navigable portion of the river is alternation of pool and bar,—sand bar for the most part.

2395 CHARLES M. COEN, called as a witness on behalf of the Government, testified as follows:

Direct Examination by Mr. Cressy.

I am fifty-nine; reside at Washington City, D. C.; boat builder, vessel builder. I am the inventor of a special kind of boat, new boat, comparatively new. It is termed the "Coen System of Propulsion." The system itself particularly is a means by which the propelling wheel which is a screw wheel of the ordinary type is located up in a wheel chamber above the bottom of the boat, having an extended dome so as to receive the full weight of the atmospheric pressure from the outside on the wheel itself in the lower part of the boat.

2396 That wheel chamber may be placed at any point in the bottom of the boat, thus allowing the bottom of the boat to be the lowest part of any part of the boat.

COUNSEL FOR GOVERNMENT. I will call your attention to the drawing which appears on page 1727 of the abstract of the record in the case of the people of the State of Illinois *ex rel. vs.* Economy Light & Power Company, and ask you if that is a copy of the drawing of this type of boat which you have just described? (Handing book to witness.)

The WITNESS. Yes, sir, it is. And the name Charles M. Coen which appears there is my name. This method or apparatus for the propulsion of vessels was patented July 7, 1903, by an application filed October 9, 1902.

Q. Has that system of boats been used to any extent in the navigation of the waters of the United States?

Objected to, as incompetent, immaterial and irrelevant.

The WITNESS. Yes, sir, it has in some waters quite

2397 extensively. The Miami & Erie canal from Cincinnati north particularly; and around the Jersey sea coast, in the bays, inlets, rivers and other shallow waters. The kind of water these boats are designed for, was especially shallow waters. Prior to the date of the securing of this patent from the United States I was engaged in the boat business. As to my experience in the boat business prior to 1903, I will say it has been quite extensive from time to time; I have been into it more or less from the time I was quite young, my family having been in the boat business when I was quite an infant; and it has been kept up by some members of the family more or less continuously. As to whether I have had occa-

sion in my experience to examine streams and other bodies of water for the purpose of determining the kind and size of boats that could be most profitably constructed for use in such waters, I will say, yes, I have. I have made that quite a study and in putting boats in new waters or shallow waters I have most always made a survey, an examination of the stream as to whether the thing was adaptable or whether it was
2398 practical or not in such streams. As to whether in my examination I had to determine the question as to the size of the boats that I would be obliged to make in order to successfully and commercially navigate a particular river, I will say, yes, I have done that. Being asked on what rivers I have considered that problem, I will say on a great number of rivers. I just sketched off a little memorandum here, started to a little while ago: I had sixteen minutes to do it. I don't know that I have it all. It is hard to call these to mind because I have not kept up with those things after once completing the work. In 1871 I made an examination of a stream that empties into the Arkansas called the Fouch le Fevre. As to what problem I had in connection with the Fouch le Fevre, I would say I had to ascertain whether it was practicable or not to get a boat up that stream any distance that would be of commercial value and whether the stream would admit of a boat of any character or not.

The purpose of operating a boat on the Fouch le Fevre was to get the cotton and other products from the country adjacent and back of the Fouch le Fevre. I made the soundings and what is termed a survey, I called it an examination of the stream, and as to what depth of water there was
2399 in it and what size of boat could be practically put on the stream if any, that was prior to the building of the boat, it was always the first proposition. As to what depth of water I found the Fouch le Fevre to be, I will say I found about 30 inches as near as I can see from the data I have, 30 inches,—and from memory. That is in extreme low water, and that is what we had to contend with in the fall of the year when the cotton was coming out. As to what I did as a result of my examination or what was done as the result of my examination, I will say I made a favorable report that a practical boat to haul 100 bales of cotton could be constructed to run on that stream with that kind of water; being asked if my boat was actually constructed, I will say, yes, a boat 30 feet beam and 90 foot long, and run on that stream and down the Arkansas river to the Little Rock market. The draft of

the boat was fourteen inches light; 24 inches loaded. We hauled out cotton, hide and various products natural to the country and returned with merchandise of various characters, and passengers.

Q. I will ask you what other streams you have made a similar examination of in reference to determining whether a boat could be constructed and operated upon it?

COUNSEL FOR DEFENDANT. All this goes in under the objection that it is incompetent, immaterial and irrelevant; I
2400 suppose that will be understood, Mr. Cressy?

COUNSEL FOR GOVERNMENT. Yes, it may be so understood. I will state that I am making this examination for the purpose of qualifying the witness in reference to later testimony. Now read the question, please.

(Question read.)

The WITNESS. Well, in the upper Arkansas river and in the vicinity of Fort Smith the same examination as to the practicability of putting a boat into that river was made, and surveys made, soundings and all that sort of thing, after which a 32-foot beam, 130-foot long boat was constructed and put in the water. It would draw 14 inches light and 24 inches loaded. The minimum of water that I found in the upper Arkansas was twenty-eight inches in low tide, low water. As to what type of boats those two boats were that I constructed on the Fouch le Fevre and upper Arkansas, I would say what was generally considered the old style of flat bottom stern wheel boat with a little variation; they were made pretty light. Being asked what other examina-
2401 tions I have made in reference to determining the navigability of streams, I will say in 1898 I went over the Yukon river with the idea of putting a boat up there for mining purposes. There was water at times but they could not depend on more than twenty inches at any time. I constructed a boat to go up there which contained about forty or fifty tons of machinery for mining purposes which contained a sluice-box within the wheels of the boat, which was 110 feet long by 28-foot beam, with all the machinery necessary and some machinery for repairing tools and keeping various tools in order that were used in mining purposes. The name of that boat was the Yukon; she drew 14 inches loaded. As to what she drew light, I will say that was the high water line too, because she was not a transportation boat. She was only for the purpose I have spoken of, this mining purpose, unless they got gold enough to load her

down. As to what experience I have had in recent years along the eastern coast of the United States, with reference to determining the navigability of any streams or rivers,
2402 I will say I made a report in 1910, that was recently, last year, for the Coast Canal Company, an organization under the laws of New Jersey as to the practicability of putting a boat line through what is called the Coast canal. It is an inland waterway inside of the coast that extends from Tom's river down to Cape May with one or two breaks in it. I made a report on it. I made a report of the soundings, a complete survey from Tom's river to Cape May, to ascertain the practicability of running boats that would draw three feet and a half of water through there; whether or not it could be done when they were loaded, and I found it could; but on that water they used other boats. I made no boats for that. I only made the survey and this report for the use of any boats that they could use there that drew three and a half feet of water. As to whether I have made a number of other reports of this character, I will say, yes, quite a number. Being asked in my examinations as to whether I have had occasion to measure the depths of the rivers, the width of the rivers, the velocity of the current,
2403 the locations of boulders and other impediments in the stream, I will say, yes, that is a part of the proposition of making a survey. It has got to be practical, so that a man putting a boat in there, spending all this money, has got to know something about it, as these rivers usually were not surveyed by the government. One other very exhaustive report I made was on the Trinity river in Texas. There was a question of putting a bridge across the Trinity river below Dallas, the people contending that it was a navigable stream and the railroad company contending it was not. I was called upon to make a report upon it as to the practicability of that thing, whether it was or was not practicable. For some three hundred miles or more, it was quite an extensive thing. I built a small boat for the purpose of it, employed men and started out at Dallas and went to the mouth of the river, took the necessary time and made a favorable report as to the practicability of putting a boat on the Trinity river, as it was, with the understanding that a great amount of logs and trees must be taken out of the river that laid across it in various shapes and forms. There wasn't anything else to prevent it scarcely. As to what the size of

that boat I constructed on the Trinity river was, I will say after making the survey, I constructed a boat 20 feet
2404 beam by 130 feet, to navigate from the lower river up, after making this report. That boat draws 18 inches. That was the load line, it took freight on that trip us. As to whether there were obstructions in the Trinity river at the time I examined it, I will say yes, quite a number of trees and and logs mostly. Being asked when I made these various examinations what I did to determine the question as to whether the river was capable of being navigated or not, I would say I first generally go to the head of it, wherever it is, and built a flat-bottom workable boat of some character which can hold three or four men comfortably; secure the necessary apparatus for soundings, sounding the river and making a plat of it, taking the contours, noting the obstructions, such as logs and various things that can be taken out. That is about all that is required in a thing of that kind. As to whether I had occasion to measure the velocity I will say yes, I always do that where there is any question about it. I have
2405 had occasion in my work to make use of government surveys many times. In a great many instances these rivers, such as the Trinity was navigated before the government had entered them and made any surveys. In these cases, of course, we cannot avail ourselves of their work. As to what is the shallowest draft of a practical boat that can be constructed for the purpose of navigating extreme shallow waters for commercial purposes or for other purposes, I would say that will depend entirely on the load you desire to carry, if it is a freight boat. If it is purely a pleasure craft, why, that is easy then; you can figure on it, count on it. I will describe some of the shallow draft boats that I have constructed for use on extreme shallow water for pleasure purposes. One boat in particular I built down the Mississippi river, it is called a house boat usually or a pleasure boat, for a man and his family; that boat drew three and three-quarters inches with all her equipment, with two gasoline engines on it, driving a 20-inch wheel, one wheel on either side. That boat, as I remember it, was, I think, 28 by
2406 78 or 30 by 79. Being asked if that boat has been operated to any great extent, I will say, yes, they made a trip down the Mississippi river and around the coast of Texas and down into Mexico, as far, I believe, as at Tampico, and back up the river, and after that she made another trip, and was down in South America the last time I heard of her.

They went around down into Brazil and down into Buenos Ayres and up the river that puts into there at Buenos Ayres, whatever the name of it is. As I understand it, they went up all of the streams they encountered, went up the Amazon, I am told. As to the construction of boats for commercial purposes I made eight boats out here in the Miami and Erie canal that drew, without any freight on them, seven and a half inches; some of them up to nine inches. Those boats draw when loaded three feet. Those boats are largely used by Mr. Fox in connection with his paper mill. Those boats were constructed in 1904, I believe. They are still in
2407 operation. Prior to the construction of these boats on the Miami and Erie canal by Mr. Fox I made an examination of that canal for the purpose of determining the size of boats that could be built. As to what depth of water I found in the Miami and Erie canal, at the time they were examined, I will say 28 inches. Being asked if I am constructing any boats or contracting for the construction of any boats for the navigation of any shallow water of the State of Illinois, I will say, yes, I have some boats under contract recently. I have got 28 boats under contract for this Illinois and Michigan canal that runs from here to Calhoun County, Illinois, and St. Louis. The size of those boats is 17 feet by 104. They will draw between 8 and 10 inches. The size of the engine has not been determined yet; that makes a difference possibly of an inch as to either one of them. Say anywhere between 8 and 10 inches. They will draw when loaded about four and a half feet and will carry 200 tons. Being asked if I have any other boat under contract for the navigation of shallow waters of Illinois, I will say yes, I have a boat recently contracted for, called a shell boat, for securing mussel shells out of shallow creeks and rivers, anywhere in the United States. Principally in the Sangamon river and Crooked Creek, and some other small shallow creeks. That will be a boat of 38 foot beam, 141 feet long. It will have two 110 horse power gasoline engines, one on either side and it contains the dredging apparatus of 70 horse power, to be operated by dredge; steam boilers and pumps necessary to operate the dredge and the machinery for washing the shells, and so on. The total weight of the machinery will be 50 tons about. Exclusive of the 50 tons of machinery it will carry 200 tons of shells to a shipping point. Being asked what the boat will draw, without any other load than its machinery,

I will say about nine and one-half inches and it will draw when loaded with 200 tons of mussel shells about 22
2409 inches. As to whether this boat was specifically constructed for shallow water navigation, I will say, yes. One place that brought the matter up was in the Sangamon river, where there were a great many sand bars. The depth of the bar is 14 inches. The boat can be loaded down to 14 inches above that bar, but that is as far as she can be loaded to, at that point because they cannot get out with more than fifteen inches. Being asked as to whether I have made an examination of the Desplaines river to determine whether a boat could be constructed that could navigate the Desplaines river from its mouth to Dam No. 1, I will say yes I made an examination and observation last Friday, the 24th. Prior to making my examination I inspected the maps and surveys which accompany House Document No. 263, of the 59th Congress, first session, being a report upon the 14-foot waterway. The maps I inspected accompanied that report. I don't know if that is it; I inspected a map accompanying that report.

At the time I made that examination there were with me
2410 Mr. Cooley, Mr. Heilbron and Mr. Cressy. As to what I did in that examination I will say I started Friday morning from here, at 8:35, I guess, the train went from here to Joliet. Then we took an automobile and first went to Jackson street bridge and observed what was pointed out to me as the beginning of the river where this contention arises. I have taken the measurement there of the velocity of the water and the height under three bridges. Being asked if I ex-
2411 amined the bridges over the river. I will say, yes, took all of them. I can name them to you, Cass, Jefferson and McDonough. Being asked if I made any examination of the railroad bridge at Joliet, I will say a very critical examination of the Rock Island bridge particularly on account of the obstruction from the piers there as the piers appear to be set at about an angle of 40 degrees across the river. They were long piers and seemed to be quite an obstruction there. I also took the velocity of the water by measurement below the bridge where it seemed to be of a greater velocity than it was at any other point. I examined the river at a bridge which I was informed was the Brandon bridge. At Brandon's bridge I noticed the location of an island above. I examined the river at Treat's Island. I went to the head of the island and measured the velocity of the water at the head of the island and

then down along towards Brandon's bridge. I examined Millsdale bridge also, and I also went to the foot of Treat's Island and made measurements there as the water seemed to run quite rapid there at the junction of the other branch that became connected with it from the north side. Being asked
what I did to measure the velocity of the water at those
2412 places and Treat's Island, I will say that this place I
speak of now, at the foot of that island I measured the velocity of the water with a line 100 yards long. I put out a float that floated rather deep in the water so as to get the full benefit of the velocity and cast that into the water above the point where we took the measurements so as to give it time to get under velocity, and then noted the time that it took that block to float 100 yards or 300 feet, with a stop watch. The point at which I made these measurements at the foot of Treat's Island, was about, I should say, 200 feet from the point of the island. Being asked if I took any observations in reference to the condition of the water at that point with reference to the velocity as compared with other points in that vicinity at which I took measurements, I will say, yes. As
to what those observations were I will say I can do it
2413 with a piece of paper better than anything else. The
northern confluence or branch of that stream there that makes that turn, comes in at what I term the foot of Treat's Island where they come together and at that point there seems to be a dip in the river, in fact the government maps show that; what we call a dip, you know, is where there is a steep point in the river, and at that place there was a dip which seemed to draw the water through quite rapidly, much more so than at any other point. I took measurements there, two different measurements. I took that float and cast it up the river far enough to give it its full velocity at the time it got to the point where I made the measurements, and I found it took 39 seconds in one instance to make the 300 feet, and in the other instance it took 40 seconds. As to how I would explain the discrepancy in that case, I will say we cast the block out five feet farther into the stream in one instance that we did in the other. That next to the shore was 40 seconds and the one five feet farther out, that difference of five feet farther out from the shore seemed to make the difference, that is the only way I can explain it. Being asked what rate per hour
that would be, I would say I don't remember that ex-
2414 actly—yes, it is 5.2 miles an hour, in round figures. As
to how the water where I took that measurement would

compare in reference to swiftness with the water in the vicinity there at the foot of Treat's Island, I would say that was the swiftest water there was there as far as we could observe. Being asked if I made any other measurements on Treat's Island, I will say, yes. As I said before, on the upper end of Treat's Island, where the velocity seemed to be greater than at any other place up in that vicinity. I measured it at that point by sectioning off a section of land and taking our points at right angles crossing the creek, and tossing a float in and taking the time it took to travel 100 feet. The result of that measurement was, it took 20 seconds to travel 100 feet. I used a tape measure in measuing off the land and a stop watch in getting the time. As to whether in my investigations I have made of other rivers I have had occasion to measure the currents at points, I will say, yes, repeatedly. I have made a sufficient examination of the government profiles and soundings
2415 and surveys as shown by House Document No. 263, and examined the shallow places shown on those profiles so that I feel that I am competent and able to answer the question as to whether the Desplaines could be navigated by a shallow draft boat.

Q. I will ask you as to whether the Desplaines river from dam No. 1 at Joliet to its mouth was capable in the condition as it existed on Friday the 24th day of March, 1911, of being navigated by a shallow draft boat?

That is objected to, as incompetent, immaterial and irrelevant; as calling for the condition of the river not as it existed in its state of nature but as affected by the works of man; and on the further ground that no proper foundation has been laid for the testimony.

The WITNESS. Yes, most positively.

Q. Would you say that the Desplaines river in the condition you saw it in on the day you examined it, to-wit, the 24th day of March, 1911, was capable of being navigated profitably for purposes of trade and commerce both up and down from the City of Joliet to the mouth of the river?

That is objected to, as incompetent, immaterial and irrelevant; as calling for the condition of the river not
2416 as it existed in its state of nature but as affected by the works of man; and on the further ground that no proper foundation has been laid for the testimony.

The WITNESS. Yes, I do.

Q. What sort of boat could be operated upon that river between the points mentioned profitably?

COUNSEL FOR DEFENDANT. May it be understood that the objection goes to all questions of this character, Mr. Cressy?

COUNSEL FOR THE GOVERNMENT. It may.

The WITNESS. There are several sizes could be used on there. The one I recommended to the parties was 24 by 78 so as to haul fifty tons of freight easily. The draft of such a boat would be light, about 8½ inches. And when loaded not over 18 inches. On that 18 inches it would carry a load of fifty tons. Being asked if it would be possible to construct such a boat so that she could go up the currents that I observed in the Desplaines river at the points referred to, I will say, yes, positively. As to whether this boat could navigate the Desplaines river at the foot of Treat's Island, I will say,

2417 yes, this boat could navigate the Desplaines river from the Millsdale bridge up to the head of Treat's Island and this boat could navigate the Desplaines river under the bridges at Joliet. Being asked as to whether on March 24, 1911, I made an examination of the river for the purpose of determining these questions, I will say, yes, I did. As to what I would say as to the capability and practicability of navigation for trade and commerce from the point where the coffer dam is now situated at the mouth of the river up to Joliet, taking into consideration the possibility of securing commerce and the possibility of physically navigating the river, I will say I think I have answered the physical part of it. I will answer it again in the affirmative. The other, of course is a matter of business. I have made a number of inquiries at different points as to the demand or use for a boat in there and I was very much encouraged on the outlook as a business proposition. As to what place I made in-

2418 quiries at I will say, at La Salle, Peru, Morris, Joliet and Chicago. I examined the Desplaines river at its mouth where the coffer dam of the Economy Light & Power Company is now situated, on this same day March 24. Being asked if I made an examination of the contour of the river at that point and the velocity of the stream, I will say, yes, I made observations. As to whether if the coffer dam were removed what would be the effect of such removal upon the question of the profitable navigation of the Desplaines river I would say, it would give a clearer channel through there. As it is today it seems to me it would be neces-

sary to hit a certain point there to get through which was the idea of making the boat so narrow as I named a while ago. Otherwise I would make the boat wider if it was not for that thing. That coffer dam is quite an obstruction without any doubt to navigating—quite an obstruction in navigating the water there. Being asked to assume that opposite the dam in question there has been excavated from the south bank of
2419 the Desplaines river a sufficient amount of dirt and other obstructions so that the opening is as big as was the opening in the condition prior to the erection of this coffer dam; and what would I say as to the condition of the current prior to the installation of the coffer dam; and what is the effect of the coffer dam on the current, I would say the coffer dam breaks up the current at that point into waves, but that is not the point; the velocity of the water is much greater there by the abutment extending out into he river. I refer to the abutment, I will say on the opposite side of that river from the side we were on; the north side of that river.

Q. And that abutment is the coffer dam, is it not? There was no other abutment there other than the coffer dam?

The WITNESS. Well, there is an abutment on the opposite side of the river and a dam also, or a coffer dam in the bottom of the river. There is some obstructions put in the bottom of the river. It looks as though a dam had been started in there. In other words the abutment on the opposite side of the river has narrowed the river unquestionable greater than the excavation on this side if any.

That is objected to, on the ground that the question assumed that the excavation had been sufficient to leave
2420 the width of the water the same as before the excavation.

COUNSEL FOR GOVERNMENT. Now, answer the question on that assumption, that the opening was as big as was the original opening; answering on that assumption, what would be the effect of that abutment or coffer dam in the river upon the current?

The WITNESS. Well, it makes the water more rapid at that point, because the abutment has backed up the water there from its natural channel and raised it probably several inches there, and when it strikes that dip there it goes down with a whirl. It makes it a great deal more rapid without question. Assuming that the width of the channel is the same now with the excavation in it as it was prior to the excavation of the coffer dam, the current is not the same, I would say,

because the abutment backs that water up, turns it from the channel and raises the water in the river necessarily. Being asked if I made an examination to see whether the assumption just put to me was or was not correct, I will say, I don't think it was correct. I think the channel was narrower than it
2421 was in nature. In answer to the question "did you make any examination to see," I will say, yes, the result of my examination was that I found the abutment extended in the river farther than the excavation; seemed so from this side. Considerably farther, thus narrowing the flow of water. The abutment backs it up, beyond any question; acts as a wing dam in other words.

Cross-Examination by Mr. Scott.

As to these boats that I have referred to where the propeller is in a wheel chamber that I say are operating on the Miami and Erie Canal, around the Jersey coast, bays, inlets and shallow waters and being asked to mention specifically any bays, inlets or rivers on which they are navigating outside of the Miami and Erie Canal, I will say, I cannot remember the name of that bay there at Atlantic City, Gardner's Bay is one of them, and there is another bay or inlet that
2422 empties into Gardner's Bay that comes in there; and in to this inner coast canal. As to the character of the waters on the Miami and Erie Canal in so far as slopes and velocities are concerned, I will say I think that the velocity of that canal is about two miles an hour, as near as I can remember. I made an observation at the time. If my memory serves me right it is about two miles an hour. Being asked if there are any of these boats invented by me that are navigating anywhere on swift waters, and if so where, I will say, the flow of those tides there around Atlantic City and those places run sometimes six or seven miles an hour. Being asked if I speak of the tides as being currents in the sense that I speak of the velocities of currents, I will say yes. As to whether I can name any rivers or other streams in which boats of
2423 this type are being navigated, I will say, I cannot tell the names of those—well, let me see; I cannot call the name of those waters on the Jersey coast. They are quite familiar to me too. There is one inlet there that is probably six or seven miles an hour in the tide. I cannot name it, however at the present time. As to whether that depends upon

the tide entirely, I will say altogether there. Being asked whether I can name any river where the water is swift depending upon the slopes of the river, I will say, no, not now. Being asked if my boats have been navigated upon any such river that I can now name, I will say no, outside of tidal rivers. As to my having recommended certain boats for the Desplaines river, and being asked if those boats are of the type which I invented and which have the chamber in which my propeller is placed, I will say, yes. That is the kind of boat I have in mind, the propeller there. Being asked whether the lowest point of it will be at least as high as the bottom of the boat, I will say yes. As to what is the shallowest water on which any boat of my type built by me has been opearted,

I will say 3¾ inches. That is a boat with a dome. It has
2424 been operated up and down the Mississippi river and around the shores of the Gulf of Mexico on 3¾ inches. I know actually of its being navigated in water of that depth up and down the Mississippi from Memphis to the gulf. There are places there where it is necessary to navigate on 3¾ inches of water if you want to go in shore. I have of my own personal knowledge known it to be operated on 3¾ inches; seen it done on the Mississippi river. Being asked if I went down in it, I will say yes, I can beat that too. As to whether a boat drawing 2¾ inches of that type could be operated on water as swift as the Desplaines river, I will say, yes. I can give you another one that is worse than that, and describe every detail of it. Built in 1879 well, my first experimental boat,
2425 drew 3½ inches, and we used her as a freight boat on the Arkansas river at New Gascony and below Pine Bluff. As to how many tons that boat was intended to carry, I will say about 40,000 pounds. It drew light 3½ and when loaded 8½ inches. As to what the character of the river was where that 3½ inch boat was operated I will say about the same as the usual rivers of that type; it was during a low water period that I was there. There was not over a three mile an hour current I should not imagine, if that. As to over how much of a stretch of the river that boat operated, I would say possibly about twenty miles from there up to Pine Bluff, and about 100 miles to the mouth of the river. Made the trips to Pine Bluff two or three different times, and to the mouth of the river; once I made that trip myself. That
2426 was the Arkansas river. The Arkansas river when up runs six or seven miles an hour usually all along it and

has rapids when low. Being asked how that boat came to be built, I will say as an experiment; the first Coen boat I ever built. It was one of those dome boats. I built it myself. Being asked if the river has been used for navigation by boats of other types for commercial purposes prior to that time, I will say, yes, and was then. As to what those boats drew that were used in operation for commerce on that river I would say on that end of the river there I think about 5 feet. As to how long that boat which I built continued in operation, I would say about six weeks. I had a contract for building a cotton seed oil mill down in Texas, and left there at the time and ran it up in a bayou there and took the machinery out that was borrowed from the gin mills on a plantation there, most of it, got the machinery out and ran it up into a bayou and piled drift wood on her and burned her up, because I had not patented it. As to how many trips I made on her I will say I made several trips around in that neighborhood
2427 there. Being asked if I went into the business of carrying freight at all on her, I will say we took some freight, yes, forty bales of cotton up to Pine Bluff one time. Being asked if I advertised for business, I will say no, I would like to explain that whole thing. The occasion for building that boat, as I stated a few moments ago, was an experiment. When I first got the line on this wheel chamber scheme of propulsion with the wheel above the bottom of the boat, I was up in Colorado and was going back down to Texas, and I stopped off there to visit my father who had loaned a man a considerable amount of money on a cotton plantation. He was simply living there for two or three years to get his money back, to get the thing closed up, and I had planned this thing out in this way. I have invented quite a number of things. I submitted this thing to him, he being a boat builder, and asked him what he thought of it, and he said it would work. I remarked that if he would loan me seven or eight negroes handy with tools, there I would build it and try it out. So he did so and I built it. I was about six or seven days building it, I guess, and I borrowed the power out of a gin mill there to put on it. Everything was improvised al-
2428 most. I built it simply to try out to see whether I had a practical idea or not, whether it would work or not. That was the only reason for it. Not having it patented I didn't want it to come out, so I destroyed it. My business prior to the building of the boat had been building railroads,

cotton seed oil mills and boats. I had built quite a number of boats prior to 1879. I had built one out on the Wabash river, a small boat. Flat bottom stern wheel boat, the regular kind. I don't remember the length of it now; perhaps about 110 feet probably by 30 feet. Being asked if I built that for myself or somebody else, I will say no, it was a commercial boat. As to whether I had a boat works at that time I will say no. People don't have boat works all the time when they build that kind of boat. Being asked if I built that boat for
myself, I will say, no. My father was one of the stock-
2429 holders and I was another one; I don't remember the
names of the other parties now. As to where that boat operated, I will say on the Wabash between Vincennes and the Ohio river and down in the Kentucky river. As to when I built that boat I will say that must have been about 1870, 1871, possibly. At that time I was about eighteen or nineteen years old. Being asked if I operated that boat, I will say, yes, very extensively. Being asked for how long a period, I will say, well, at different times I did. I hadn't a captain's license, but I generally commanded a boat with a licensed man on it. I should say I was there off and on probably for a year. The next boat I built after that, it seems to me like it was on the Trinity river probably as near as I can remember. That boat was built I think about 1871. That was of the
same style of boat, flat bottom, stern wheel. I think
2430 that boat drew about a foot light. As to how much
loaded, would depend altogether on the load. I think there was not more than two feet of water in the river at low tide. As to where I operated her from, I will say Buffalo Bayou on the coast of Dallas, Texas. As to how often I operated her between those two points, I will say, once, took her up. That was in this demonstration of possibility of the Trinity river. Being asked who you built her for, I will say built it for a company there, a man by the name of Williams was the biggest man in it; Colonel D. A. Williams. Being asked if I took a load up, I will say part of a load. It was some merchandise from Galveston. I don't remember exactly. I think molasses and sugar, possibly coffee. As to
what season of the year, I think it was in the spring,
2431 late in the spring; it was low water. Being asked what
then became of her, I will say I don't know what they did with her after that. I think the intention was to demonstrate that that boat could run there. I had nothing to do with

it after that. I don't know anything about the ultimate fate of the boat. As to whether they keep up navigation between Dallas and Galveston, I think not; not for any extended time; there were too many trees in the river. As far as I know she did not go down the river after I took her up. I was about eighteen or twenty at that time. That was 1871. Being asked if I have any technical education, I will say no. Being asked what my occupation was before I built this boat on the Wabash I will say I didn't have any special occupation; I was going to school most of the time. Being asked if the building of this boat was the first thing I did, I will say that was the first—the first boat I built. That was not the first boat I had a hand in building. In times during vacation times
2432 I was generally doing something of that kind. As to what schools I was in, I will say just the common schools. I have not been educated as an engineer, only as I have educated myself. My father was a boat builder, in Virginia, on the Ohio river, St. Mary's. As to how long my father followed that line of business, I will say he was in it from the time I remembered him. I think until about 1870 or 1872, say; 1872 or 1873, something like that. Being asked at St. Mary's, I will say, no, he was out in Illinois part of the time—or in Arkansas. He followed the business to my knowledge
2433 on the Ohio river up to about 1868 or 1870. I don't know how many boats he built there. As to whether I remember his building any steamboats on the Ohio, I will say, yes. I don't know how many. He was not all the time up to 1868 or 1870 at St. Mary's. He was up and down the Ohio
2434 and Mississippi river; New Orleans, and all. He was navigating boats at the time. He was what is called a river man. He was running lumber and rafts and boats, and all that kind of thing. Being asked if he had any boat building work on the Ohio river at any time, I will say, yes at St. Mary's. For how long, I don't know. He had it up there until about 1864 or 1865, boat building work. At that time I was about 12 years or 13. As to how long he was building boats at St. Mary's, I don't know. He had been at it from the time I knew him. He had also been operating on the river. Had large sawmills and all that kind of thing. When he
2435 moved from the Ohio, I think he went to Arkansas; Little Rock for a while, and then other places. Then he was over to New Madrid, over on the Missouri, I believe. As to what time he went to Little Rock, I think he was there off

and on at different times. I think he went to New Madrid, Missouri, about 1864 or 1865. That is about the time he left St. Mary's. I think that was his next residence. I think he was in the lumber business, and building boats occasionally. I don't know whether he built any boat at New Madrid or Memphis; I can't remember the place now. I think he built his next boat at Paducah, Kentucky. That was a year or so after that. That would be 1866, something like that. I was with him most always. Being asked whether that was a boat he built for his own use, I will say partly. He was one of the owners. As to what other boats he built on the
2436 Mississippi river, I don't remember now. I cannot tell the names of them. I don't remember the name of any of them. As to how long he continued to live on the Mississippi river, I think he was there three or four years, five maybe; between there and on the Ohio river. That would take him up to about 1869 or 1870 something like that.

Q. Did he then move to Arkansas?

That is objected to, and I object to further cross-examination with reference to what his father did, as not proper cross-examination.

The WITNESS. I don't remember the date, but I think it must have been about 1868 that he went to Arkansas.
2437 He located in Little Rock. He was in the lumber business and boat business there. I don't remember of his building a boat there. As to whether he built any boats after 1868, I don't know that he did. I said I had the ordinary common school education. Being asked if I went with my father on these various moves, I will say a great many of them. His home was my home up to about 1868 or 1870. I went to school at various places. I went to school in Arkansas. This boat on the Arkansas was constructed about
2438 1879. In was 1870 or 1871 that I built a boat on the Wabash. Being asked if my father moved back to the Wabash, I will say he did not. As to how I came to build that boat, I will say I heard that they wanted a boat and it looked like business. I built it. After building that boat I went back to Arkansas and stayed here until 1873, I think. In the meantime though I had been in Texas during that time. Then after 1873, I was building railroads, I think, on the Little Rock & Ft. Smith Railroad, putting up the dirt
2439 and rock between Clarkesville and Fort Smith. I was engaged on that about a year. After that, I think, we

built that boat up there at Fort Smith about that time. That was about 1874. That was the boat 32 foot by 130 foot. As to a contract I had for building a certain part of a certain railroad; and with whom that contract was, I think it was a man by the name of Homan. He was president of the road. That is part of some system now existing; it is the Frisco, I believe; it runs from Ft. Smith, Arkansas, to Little Rock. I couldn't tell you what system it is now. It is a matter of record, of course. The contract was in my name.

2440 Q. What was the extent of that contract so far as the price for the work that you did is concerned?

Objected to, as not proper cross-examination.

The WITNESS. I don't remember.

Being asked if my contract was with the railroad or with an individual, I will say, with a man that had the general contract for laying the iron and everything else; a general contractor. I was a sub-contractor. As to how many employes I had, I don't remember that, two to three or four hundred at different times. The original contractor was a man by the name of Homan, I think. I do not remember his first name. As to whether he is living now, I don't know; I think so. At St. Louis, probably. I think he lived at Little

2441 Rock; made his home there. Being asked if I have done any work of that character before, I will say, yes, on this Springfield & Illinois Southeastern. That must have been along about 1868, something like that. I had charge of the commissary department of the construction of this railroad. They called it the Springfield & Illinois Southeastern. It now belongs to the Ohio & Mississippi, or Baltimore & Ohio, rather. As to between what points it was being constructed at the time I had the contract, I will say Shawneetown on the Ohio river to Pana, Illinois. Being asked if I had the contract for the commissary work for the entire work, I will say, no, it was not a contract job. It was a salaried job. As to how long I was there I don't know; I think I was there about ten months. I was working under the president of the road, George W. Norris. Being asked if he is living yet, I will say I could not tell. Being asked what my duties on that job here, I will say I bought all of the supplies and had charge of the feeding of 400 to 500 men and the team

2442 and everything of the kind. This must have been about 1868 or 1869. I was born in 1852. I think I had my 17th birthday on that job if that is what you are getting at. As to the boat I say I built at Ft. Smith, that boat was built

about 1874. My father did not have anything to do with that boat. I built it for some parties there at Ft. Smith. Some fellow that was in partnership by the name of Blanchard; I don't remember the other fellow's name; Wilson, I believe. I do not know the first names of either of these men. That boat was built for freight service, between Ft. Smith and Dardanelle, if I remember properly. The dimensions of that boat were 32 by 130, draft, light, 14
2443 inches, and loaded 24 inches. As to how long she was in service, that I don't know. I didn't know her very long. I was in and out of there. I don't know what became of her. Being asked what other boats I built besides those I have mentioned up to the time that I began the manufacture of these patented boats, I don't remember of any. I think I was railroading and building oil mills from that time on up until 1879, if I remember properly.

Q. When did you go into the oil mill business?

Objected to, as not proper cross-examination.

The WITNESS. It was along after that period, after 1874. As to how long I remained in that business, I will say, off and on up until the time I built this boat. I got the contract at the time I built this experimental boat down on the Arkansas river in 1879. My headquarters were Memphis.

Q. Did you have a factory?

Objected to, as not proper cross-examination.

The WITNESS. No, sir, a man don't have to have a factory building, a thing of that kind. Being asked if I had a
2444 place of business there, I will say, yes, that was my headquarters at Memphis.

Q. What did they consist of?

Objected to.

The WITNESS. An office.

Q. Where was that in Memphis?

Objected to that as not proper cross-examination.

The WITNESS. Gayose street. I don't remember the number. Gayose near Beale. As to what years I was there having that headquarters at Memphis, I think from that time on until about 1885 or 1886; I was building electric light plants then. Being asked if I had quit the oil mill business, I don't know; I should think that 1879 contract was the last one I had. Being asked where I put in the electric light plants, I will say San Antonio, Texas. I contracted for them and put them in. It was 1883 or 1884.

COUNSEL FOR THE GOVERNMENT. May an objection go as to all these questions so far as they do not pertain to the manufacture or construction of boats and the examination of rivers, without repeating the objections?

COUNSEL FOR DEFENDANT. Yes.

2445 The WITNESS. As to what other electric light plants I built, I will say Memphis, Tennessee. I think that was about 1882, 1885, maybe. I was the contractor for building that plant for private individuals. A fellow by the name of Mike Burke was one, a railroad builder, and Tom Duffin, another railroad contractor, and George Arnold, another railroad contractor. It was a company they had. I think it was the Memphis-Houston Electric Company. I built an electric light plant at Vicksburg about that same period.

2446 As to the name of that company I will say Captain Mattingly was the head of it and the president of it and the only way I can tell about those names, I am bad on names, is the fact that the system generally took the name of the company with the addition of the town it was located in. I guess it was Vicksburg, Thompson Houston Electric Company. As to how long I stayed in the business of electric light building, I will say about 1886 or 1887. As to whether I had any other business at the same time, I will say, yes, I chucked in a boat once in a while. Being asked if I built any boat after 1879 until 1886 I don't remember, I don't think I did. After 1886, I was in the building material business as well as in the real estate business, in Washington and New York. As to what period I was in Washington, I will say I have been there off and on ever since. I have made my home there since about 1886 or 1887. I have been in

2447 New York part of the time. As to what part of that time I was in the building material business, I would say a great deal of it. I have been interested in the Ricinate Fire Proofing Company; interested in it yet. I went with them about 1887, I suppose, or 1888. I am the treasurer of the company. The office of the company is in Washington and New York. Their office in Washington is the Bond Building. Their office in New York is 96 Broadway. They make fire proofing material for building. They treat all kinds of inflammable material such as wood, for instance, and everything that is inflammable that enters into buildings. They treat it for fire-proofing. They

2448 have a plant in New York on Hudson street. I don't remember the number, it is near Franklin. The

plant consists of a plant for compounding and manufacturing a compound called Ricinate. That occupies a building. The office is up town, as I told you, 96 Broadway. Out at its factory is mixing machines and all that kind of thing. As to what kind of a factory it is, I will say they don't occupy the entire building; they rent a space generally about 30 by 100, something like that. They make a kind of a fire-proofing compound too.

Q. What is the capital stock of that company?

Objected to, as not proper cross-examination. All this is immaterial since my last objection, and I move to strike it out.

2449 The WITNESS. I think it is $1,000,000. I have also been in the real estate business, not very extensively.

COUNSEL FOR THE GOVERNMENT. Let my objection stand to all questions concerning the real estate business.

The WITNESS. Being asked if I have an office in the real estate business, I will say not now. I ceased to have one I think about last June. As to where it was, I will say in New York at 96 Broadway; Scimmerhorn Building. My real estate operations was mostly in New York. As to how long I was in that business, I think I went in it in 1891. Being asked if it was continuous up until the time I say I recently abandoned it, I will say, at times there was something doing, and then it was not such a thing that you had to con-

2450 tinue it right along. You took it up from time to time. I had an office force part of the time, two or three people. Well, for a number of years I had my office in the Lincoln building at first, I believe. My office was engaged in real estate business and also was devoted to this fire-proofing. As to whether there was anything else, I don't know just now, not unless it was something in a speculative way. Being asked after 1886 when did I next take up the boat business, I will say 1904, that is in constructing boats. I have made several surveys of streams and different things of that kind. As to where, I will say Cincinnati, Ohio. Then I built this patent boat of mine and built it at Cincinnati. I did not have my own yard there; I rented. Being asked did you operate the working yard yourself, I would say, under my supervision. As to whether it was my yard or somebody else's

2451 I will say somebody else's; rented. I don't remember the man's name now, just this minute, I can't call it to mind. He was not in the boat business. He was in the tank business. Being asked if I still have the boat build-

ing plant at Cincinnati, I will say, no. I had it about a year —oh, I don't know, about seven or eight months, until I built those eight boats. Those were the eight boats I built for the Ohio-Miami Canal. I built those in 1904. I gave up that yard, I only rented it for that specific purpose, just the same as I am trying to rent one here for a few months. The next boat I built after that was at Atlantic City. That was about 1906. As to how many boats I built there I will say one. It was built under my supervision. I planned it and laid it out and superintended it. Being asked if I hired the men myself to do the work, or did some contractor hire the men to do the work, I will say, well, it was both; some of it
2452 was subbing. Being asked if I understood the building of the boats as my original contract, or did somebody else take the contract, I will say, yes under my original contract and in my name. Being asked if I contracted with somebody else to build the boats under my supervision, I will say some parts of it. As to how many different parts did I contract for, I will say, I contracted with an engine builder, a hull builder and a pipe-fitter and others who did specific kinds of work. That boat was built for George S. Gandy of Philadelphia for pleasure use. The dimensions of that boat were 40 by 10.

Q. What was its cost?

Objected to, as not proper cross-examination.

The WITNESS. I think about $4,000. Being asked whether outside of the eight boats that I built for the canal and this boat that I built at Atlantic City, what boats have I built of the type that I patented, I will say none. The last boat I
2453 built was in 1906, I have no plant at this time. As to whether this house boat that I built for the Mississippi river was not a boat of that type, I will say oh, yes, I beg your pardon, that was another one. That was of this type. I said it had wheels at each side, so it did, at the bottom. That was built in 1886, when I was at Memphis. It was built for L. G. Bishop. His home is in Memphis. The last time I heard from him he was on the Platte river in Argentine.

COUNSEL FOR THE GOVERNMENT. All this is objected to, as not proper cross-examination.

The WITNESS. As to what the cost of that boat was, I don't remember.

Q. Can you state approximately?

Objected to, as not proper cross-examination.

The WITNESS. I should say about $2,800 to $3,000.

Q. Where was your home when you were in the real estate business in New York.

Objected to, as not proper cross-examination.

2454 The WITNESS. Washington and New York. I did not live in both places at the same time. Sometimes I was down to New York for a year or so, and then I was up around the suburbs of Washington, lived there back and forth. I lived out at the edge of the town in the suburbs of Washington and had a house in town and all that sort of thing. As to whether I am a man of family, I will say yes. Being asked if I moved my family back and forth from New York to Washington and Washington to New York, I will say yes. My office was in the Bond building in Washington until the time I came out here; and 96 Broadway. I came out here last October. I was here in Chicago for a time; I have been up and down the river between here and New Orleans since, looking for a boat yard.

Being asked whether my residence is in Washington, D. C., I will say, yes, it is, I claim that is my residence now

2455 until I get my family moved here. My family is not in Washington at this time. I have an office in New York at this time at 96 Broadway, but I am hardly ever there. As to where my family lives, I will say in New York. As to what my purpose was in coming out here I will say to go into the boat business, with special reference to this Coen system of boats on the Illinois river. Being asked if I had some negotiations with some people interested in the deep waterway, I will say, no. As to what induced me to come out here to take up this proposition of boats for the Illinois river, I will say because there was a good field here. Being asked what brought that good field to my attention, I will say I have been posted on this proposition continuously. I started to come out here several years ago, but I was tied up in New York. As to whether I know Mr. Kavanaugh, I will say I have met him but I am not acquainted with him. The contract I had

2456 for building 28 boats for use on the canal was for a man by the name of Woolworth. He resides in New York. I have a binding contract for the construction of 28 boats to be used for the Illinois river. They are to be constructed as soon as we can get our shipyard located so we can build them. Being asked if I have located a shipyard, I will say not positively yet. I have been since October looking about for a shipyard at different places. That shipyard is to be

somewhere on the Illinois river; I have not decided on it. Being asked is there a contract in existence which binds you to build 28 boats and binds anybody to pay me for those 28 boats, I will say yes. Being asked without condition or qualification, I will say no, it is only as to time. The condition as to the time is as soon as we can get our shipyard located. After I get that shipyard located, I am to furnish these boats, just as soon as it is possible for us to do it. Being asked if there is no condition as to the need that may
2457 develope for them, I will say, no condition, no. Being asked whether there are any qualifications of any sort, I will say, oh, yes, qualifications for everything except as to time. The qualifications as to time are just as quick as we can get a shipyard to do anything with. The parties to the contract were Mr. Woolworth. I don't know who his associates are, all of them. He is the main man. My contract is in New York. It is in the name of a corporation. The name of the corporation is the Coen Vessel Company. Incorporated under the laws of the United States government at Washington, 1904, I think, under the general corporation act. The contract on the other side is with Mr. Woolworth personally. There is no other party to the contract besides Mr. Woolworth and this Coen Company. As to where Mr. Woolworth's business is in New York, I will say, 17th and 6th avenue.
2458 He is in the 5 and 10 cents store business. They have 268 stores, I believe. Being asked if Mr. Woolworth has been in business in the matter of transportation or navigation up to this time, in New York, I will say I don't know what his qualification is in that respect, but he has been in a great many businesses. This contract with Woolworth was made, I think, in January of this year. After I came out here. Then at the time I came out to investigate this proposition I had no contract. I had the matter up with Mr. Woolworth previously for a year or two it had been talked about. Negotiations directly between myself and Mr. Woolworth. As to whether Mr. Woolworth has been out here directly to look into the proposition, I will say, no. Being asked if anybody else but myself, I will say nobody appearing here; the thing has been gone into thoroughly, however. At the time I
2459 signed this contract Mr. Woolworth was in New York, I was there at the time. He is not interested in the Coen Vessel Company. This contract was signed in New York, in his store at 7th and 17th. As to whether it was drawn by an attorney, I will say, no. I said that Mr. Woolworth

had individually made this contract. He will operate this business of building boats as one of the company. He acted for himself and his associates. As to whether I can give any light as to who his associates are, I will say, no.

Q. Give me those that you have an idea are associated with him?

Objected to, as not proper cross-examination.

The WITNESS. I don't have an idea strong enough to do that. I don't know whether they have paid him or not. I have implicit faith in Mr. Woolworth. I have been in business with him off and on a good many times.

2460 Q. I would like you to name some of these persons that you have an idea are associated with him.

Objected to, as not proper cross-examination.

The WITNESS. I think Carl H. Fowler is one. He is a lawyer at 98 Broadway. He is not connected with the company that I am a member of. As to who else, I don't remember anyone else especially.

Q. What was Woolworth obligated to do under this contract?

Objected to, as not proper cross-examination.

The WITNESS. He is obliged to pay a certain sum of money. The boats will cost $23,500 each.

Q. How much is Woolworth obliged to put up?

Objected to, as not proper cross-examination, and on the further ground it is entirely incompetent. The witness is not obliged to disclose matters of this character.

The WITNESS. Well, I don't like to go into that thing.

2461 Of course, there is no question about the thing, but it is another matter. As to the details of this contract, I will say it would be hard to tell what he had to, because we are going to sell bonds. It is proposed that he shall organize a company and that company shall issue bonds and that that company shall enter into an obligation with me to take the boats. Being asked as to how many boats will be taken and how much will be paid and whether that will depend on the floating of those bonds, I will say to a certain extent it will, yes,—no, it is intended that there will be 28; it takes that to do what they want to do. As to whether there are 28 or not will depend to some extent on how many bonds are sold, I will say it might as to the time they are put in the water. As to whether if the money is not raised it would go further than the mere question of time when they are put in the water, I will say that

would make an interesting point. As to whether these 28
2462 boats are dependent upon the success of this proposition to organize a corporation and float bonds, I will say yes, put it that way. Being asked if I have been licensed as a pilot of boats I will say I had a captain's license; that includes a pilot from the United States government, about 1905, to ply the ocean and its tributaries. I don't remember the exact wording of it. As to whether I wish to be understood that a license had been issued to me as master to navigate boats on the ocean and its tributaries, I will say yes, in the year 1905.

I took it out when I had this boat around Atlantic City
2463 there and I went and took it out so I could navigate it myself without any question there and so I would not have to hire parties I did not want. Being asked whether I have ever had any license other than that one, I will say no. I don't know whether it described the character of boat or not. That boat that I refer to is that small boat around the Atlantic coast there. Being asked if it was my custom when I was making examination of streams with reference to determining what kind of boats would be navigated upon them, to take a boat and go down stream, I will say, yes. As to whether I did that on the Desplaines river, I will say no. As to how long this investigation of the Desplaines river took me, I will say most of two days.

2464 COUNSEL FOR THE GOVERNMENT. That is all unless you have something you want to say in explanation of something brought out on cross-examination.

The WITNESS. I did intend to explain that gap in there between now and sometime back but I don't think that will help any or make any difference. The reason I did not build any more of these Coen boats up to now is because I sold this patent or optioned it, rather, to New York parties.

COUNSEL FOR DEFENDANT. When did you sell this patent or an option on the patent to the New York parties?

The WITNESS In 1905. Being asked whether the option is still in existence, I will say no, the party did not buy the patent. He did not manufacture under it. They had no license in the option to do that. It was specially stipulated they could not until it was paid for. The option expired last October, and in the meantime it lay dormant. As to what I got for the option I will say, I didn't get anything that is the reason
2465 it did not pass. It was a flat sum. As to when I first had any communication with the representatives of the gov-

ernment as to testifying in this case, I will say, I think about last Wednesday. As to who brought me in touch with the government, I will say Professor Cooley, at that time I was here in Chicago.

Re-direct Examination by Mr. Cressy.

Q. What was the contract with reference to the option on the Coen patent? What was the price contracted for?

Objected to as immaterial.

The WITNESS. Simply a flat sum of three million dollars. They would have taken it, but the railroads hit them in the head so hard they could not do it. As to whether that was the reason why no boats were manufactured during the life of that option, I will say, yes, simply that that option was such that they could not manufacture or do any business until that money was paid and they failed to pay it. The option was for three years and then it had an extension without consideration.

2467 Counsel on behalf of the government after some colloquy presented an extension of Parry Exhibit 3, extending said Parry Exhibit 3 from its original termination just west of the south forks of the Chicago river, down the Chicago river, to the mouth of the Chicago river.

2468 THOMAS F. PARRY, a witness on behalf of the government, was recalled:

Direct Examination Continued.

This profile which is now shown me labeled Parry Exhibit 3, I testified on direct examination that I drew. Since the adjournment of court I have drawn the continuance of that profile from the point where it stops on Parry Exhibit 3, to the mouth of the Chicago river.

I compiled the profile which is now shown in the following manner. From the certified record of gauge readings supplied by Mr. Wisner, of the Sanitary District, I took the gauge readings of the various points given of the high water of 1892, and platted them on here, making it continuous from the other one, to the mouth of the river and the gauge of

2469 the lake is given at the foot of Randolph street, showing the level of the lake.

The gauge readings which I used in platting that, were the gauge readings which are shown on this certified copy of gauge readings dated March 15, 1911, and signed by G. M. Wisner of the Sanitary District.

As to what other lines I used in the preparation of this extension of the profile, Parry Exhibit 3, I will say, I used the bottom of the river showing it from Marshall's Report of 1890, survey of 1889 and the dotted line bottom down there is the Sanitary District survey of 1892.

Being asked did I use any other records or any other data in the preparation of this extension profile, I will say "No."

Counsel for the government stated that he offered this extension profile in evidence in answer to the objection of counsel for the defendant on the ground that the Parry Exhibit 3 was not complete in that it did not extend to the mouth of the Chicago river, and ask to have this extension marked Parry Exhibit 3-A.

Objected to, as incompetent, immaterial and irrelevant, and that no proper foundation has been laid.

Which said profile so offered in evidence was marked Parry Exhibit 3-A, and appears in Appendix, p. ——.

COUNSEL FOR THE GOVERNMENT. And we further ask to unite these two profiles, Parry Exhibit 3 and Parry Ex-
2470 hibit 3-A, under the title of Parry Exhibit 3-B, which will show the Chicago Divide from the Desplains river to the mouth of the Chicago river. I will offer this in evidence as Parry Exhibit 3-B.

Objected to, as incompetent, immaterial and irrelevant, and no proper foundation laid.

Which said document was marked Parry Exhibit 3-B, and appears in Appendix, p. ——.

COUNSEL FOR THE GOVERNMENT. Counsel for defendant requested the government to produce a certified copy of all the gauge readings of the flood of 1892 taken upon the Chicago river. I now offer to produce this record, which I will ask counsel for defendant to examine.

COUNSEL FOR DEFENDANT. If it is understood that this is to be in lieu of proof of the facts, the defendant does not accept it.

COUNSEL FOR THE GOVERNMENT. The government offers this in evidence and asks to have it marked Cooley Exhibit 6.

Objected to, as incompetent, immaterial and irrelevant, and not proper evidence.

COUNSEL FOR THE GOVERNMENT. No objection is made to the form of the certificate, is there?

COUNSEL FOR DEFENDANT. No objection is made to the form of certificate, but it is objected that that cannot be proved by a certificate of that character.

2471 Which said document so offered in evidence was marked Cooley Exhibit 6.

COUNSEL FOR THE GOVERNMENT. Let the record show further, that the government produces for the examination of counsel for the defendant a copy of the gauge readings taken at Alexander's, mouth of Jackson creek, for the year 1910, which was requested by counsel for the defendant at a prior hearing.

Cross-Examination.

I have not made any study to ascertain how the flood line of 1892 would compare with the conditions in a state of nature, with the discharge at Riverside such as occurred in the flood of 1892. I will say I have not made any study to ascertain how the flood line of 1892 as platted in the extension which I have produced to-day, extending from Western avenue to Lake Michigan, would compare with the conditions in a state of nature with the discharge at Riverside such as occurred in the flood of 1892.

The copy furnished the defendant by the government of the extension which has been offered this morning, shows a continuation of the assumed high water line from Hoyne avenue, in pencil, or it shows a line in pencil from that point,

2472 ending at the mouth of the Chicago river. I put that line on there, merely for my own satisfaction. I was just trying it to see how it looked. It is not intended to represent anything; it is not on the exhibit.

COUNSEL FOR THE GOVERNMENT. Let it be shown for the record that by error counsel for defendant was furnished with that copy that was intended for counsel for the government.

The WITNESS (continuing): As to what was my purpose in drawing this line, I will say I was just testing from the end of the line that I had drawn without that 1892 high water line, down to the mouth of the Chicago river—I was seeing how that line would come out, if it looked probable, merely for my own satisfaction.

Q. And having tested it to see if it looked probable you omitted it from the extension as introduced in evidence?

A. Not at all.

As to whether it is omitted from the extension I would say yes and no.

2473 The line does not appear upon the map which was introduced.

As to whether if my assumed high water line in a state of nature, the dotted line appearing upon the map as originally introduced and extending to Hoyne avenue, was correctly assumed, then substantially that line would have had to continue as I have drawn it, I would say I do not know whether it would or not. I know that I drew that line to see how it would come out and it looked very probable to me, that is as the probable flood line for 1892 if projected to the mouth of the river in a state of nature.

2474 COUNSEL FOR THE DEFENDANT. Now I offer the government's plat furnished to me by mistake as being our copy, in evidence, to indicate and for the purpose only of indicating what in the opinion of the engineer who drew it would be the course of the assumed high water line in a state of nature if projected to the mouth of the Chicago river, and I will have it marked as Parry Exhibit 3-C.

COUNSEL FOR THE GOVERNMENT. In reply to counsel's offer I will say that the only instructions given Mr. Parry were to produce the extension of the profile to the lake, showing the gauge readings and the river bottom as of 1890 according to the Marshall report; and this line that was put on there by Mr. Parry was put on there without any direction whatever and it was a mere mistake that this copy which had this line just simply drawn at random on there was handed to counsel for the defendant. We have no objection, however, if counsel for the defendant desires to offer it in evidence, to its going in evidence.

COUNSEL FOR THE DEFENDANT. I offer it in evidence for the purpose only as stated in my offer.

COUNSEL FOR THE GOVERNMENT. If it is to be offered in evidence, we ask to have it offered absolutely.

COUNSEL FOR DEFENDANT. The offer is made as I made it and will not be changed.

COUNSEL FOR THE GOVERNMENT. Counsel for the government therefore offers this in evidence so that it may not be

withdrawn by counsel for the defendant if it shall prove material in any way.

Objected to by counsel for the defendant; same objections that were made to the copies theretofore introduced as to every matter except that for which counsel for defendant offered it.

Which said document, so offered in evidence, was marked Parry Exhibit 3-C, and appears in Appendix, p. .....